RAILROAD GAZETTE

THE GRAIN EXPORT SITUATION.

The advance sheets from the Monthly Summary of Commerce and Finance, issued by the United States Government, for the month of June, and for the twelve months ending with the first of July, 1904, show a great decrease in the exports of wheat from this country. Figures for a fiscal year ending June 30 are, of course, somewhat misleading for grain shipments, since they tend to divide the crop arbitrarily, and the exports of each summer and fall after the first of July are carried over into the figures for the succeeding year. Nevertheless, it is interesting to note that exports in the year under review aggregated only 44,230,169 bushels, as against 114,181,420 bushels for the twelve months ending June 30, 1903, and 154,856,102 bushels for the year ending June 30, 1902 The difference in the month of June taken by itself is even more interesting, for in June, 1903, over 5,000,000 bushels of wheat were exported, as against less than 500,000 bushels in June, 1904. The question of where the wheat goes is particularly interesting at this time. The fact that the 1903 wheat crop was smaller than any crop since 1900 only answers the question in part, for in 1900, with a crop more than 100 million bushels smaller than in 1903, the exports of wheat were some 25 millions greater; and in 1897, when the crop amounted to only 530 millions, as against nearly 638 millions last year, almost 110 millions were exported, as against 73,372,255 bushels in the calendar year 1903. It is evident, therefore, that the disproportion between crop and amount exported was in the year under review unusually great.

The first difficulty in considering statistics of the grain business lies in the unreliable method employed by the Government in obtaining these statistics. The Government receives reports through a large number of local agents; for example, postmasters in small towns in the wheat country. These agents know the gossip of the locality and are able to express an opinion as to the crop of the territory they report chiefly from more or less accurate statements received from their neighbors. They hear what Smith thinks his crop is going to amount to; they also hear what Thompson thinks Smith's crop is going to amount to. From this presentation of several points of view they can get up a rough kind of average for the Department of Agriculture; but of course the value of these figures depends to a considerable degree on the personal characteristics of the man who estimates them. It is fair to say that our Government figures do not report the situation as accurately as those issued by many foreign countries. One specific chance of error may be pointed out in the fact that the divisions between the localities reported by the different agents are not always fairly understood or carefully observed. Our Government figures report really about the same kind of a guess at the crop of the country as a whole as that which one can pick up by talking with the natives of each locality at the village stores; but this drawback is partly offset for statistical purposes by the fact that they have always been obtained in the same way; and though the figures may not be accurate for any one year, the comparison between the Government returns of a number of years gives a pretty fair perspective of the situation.

One reason for the small current exports of wheat is found in the fact that the 1903 crop was of rather poor quality, so that a comparatively large amount of it did not grade sufficiently high for export purposes. Rather than sell low grade wheat through an intermediary at a price which seems to him low, although it may be fair enough for the grade, the farmer will often keep the poorer quality of wheat at home to be mixed for feed and sold on the hoof. This, of course, largely depends on the current crop of corn, oats and other grains better adapted than wheat for feeding animals; for, if these are plentiful, they can be used to better advantage, and it is more profitable to sell the low grade wheat for whatever it will bring. Although the corn crop was good last year, it was considerably smaller than in 1902, and the production of oats was rather small, so that the low quality of the wheat kept much of it at home.

But the important fact to be noted in connection with the diminishing grain exports is that the producing capacity of the country at a present average of some 12½ bushels per acre is about taken up. This statement does not include Canada, but refers merely to the wheat-producing area within the boundaries of the United States. There is no doubt that, by the exercise of proper care, the average yield could be brought up considerably higher than 12½ bushels per acre; but the farmers, generally speaking, do not sufficiently appreciate the need of introducing new seed, but allow their old product to deteriorate until both the quality and the quantity of the wheat decrease. At present, it is probably not a serious exaggeration, if it is any exaggeration at all, to say that there is capacity in the mills for twice the wheat produced in the entire United States, without allowing any for export.

There seem to be two ways in which the amount of wheat available for export can be increased; one by more scientific planting, so as to improve the crop, and the other by further development of the great Canadian Northwest. The Canadian trans-continental lines say they are building an empire, and at present the possibilities of this great Northwest country as a wheat producer appear almost boundless. As soon as Canadian wheat enters into discussion, however, a number of other questions arise. With the present high prices in mind, the American farmers want Canadian wheat kept out, but are opposed in this by the millers, who need the grain very much, and desire legislation permitting it to be milled in transit. Of course, the millers want flour to be kept out.

As regards the competition of Montreal as an export point for Canadian wheat, it is necessary to remember that in spite of the direct rail and lake connections, and in spite of the Canadian canal system, with which the new barge canal will evidently be quite unable to compete, owing to its greater length of restricted channel and less depth, the port which has the greatest amount of miscellaneous shipping has great advantages over the smaller port like Montreal, which must, for the most part, depend on a single class of traffic. The consolation of the New York railroads in the face of the evident trend of the northwestern wheat business to Canada lies in the berth-rate business. The steamer carrying a general cargo is extremely glad to be able to supplement it with grain to obtain full tonnage, and can naturally make lower rates for this class of traffic than a steamer which depends on grain for its entire cargo. To the general freighter, grain is really a profitable kind of ballast, and the ocean rate on it might be considered pure profit as a supplement to the rest of the cargo. So it seems evident that New York, with its great general freight business, will always secure a large volume of grain, despite the competition of Montreal. It must be borne in mind in this connection that it is the berth-rate business and not the barge canal which is likely to bring the grain to New York. This point was fully discussed in the *Railroad Gazette* last fall, and need not be further elaborated at this time.

So far as wheat exports from the current crop are concerned, the recent returns from the Northwest of damage because of the wet season are rather discouraging; but the Government reports that the general quality is considerably better than last year, and it may reasonably be assumed that a greater proportion of the crop will therefore find its way to the sea ports, and less be used as feed for cattle. This view is considerably strengthened by the fact that the hay crop is extremely good this year; and this, together with the good showing made by the other grains, makes it unlikely that much of the wheat will stay at home. Even with the predicted small yield, under these circumstances it is quite likely that the exports next year will be considerably greater than they have been this summer.

But the rapid growth of the country, with its accompanying increase in home consumption, and the natural limitation of subsequent crops by the possibilities of acreage, make it seem wholly likely that exports of American, as distinguished from Canadian wheat, will tend gradually to diminish rather than increase, unless genuine improvement is made in the methods of planting. The exporters have also a potential competitor in the enormous Argentine country, as yet quite strikingly undeveloped, in view of its evident possibilities. With American energy and industrial methods Argentina could tremendously increase its wheat output, and when the development of the great South American prairies is accomplished, and they raise an amount of grain vastly in excess of the small domestic consumption, this competition will undoubtedly tend still further to keep at home the wheat raised in the United States.

THE RAILROAD TELEGRAPH OPERATOR.

A railroad officer well acquainted with conditions in the West said recently before the St. Louis Railway Club that the telegraph department of the railroads had seriously deteriorated in the last ten years. (*Railroad Gazette*, March 4, pages 153 and 163.) A prominent railroad telegraph superintendent expressed pretty nearly the same thing at the recent Indianapolis convention; he said

that good operators, being where they can readily get acquainted with the business men of their town, and well enough acquainted to accurately classify them—good, better and best—soon secure employment outside the railroad service at better salaries than the railroads pay. Unless there is a good hope of promotion on the railroad many operators stay but a year or two; and it must be admitted that this hope is not at present so bright as it was in the youthful days of those numerous operators who now occupy high positions in the railroad world. Then, the operator who was competent to act as despatcher soon filled a position of that kind and the despatcher soon became an important adviser and helper to the superintendent, in line for further promotion. The increase in business per mile of road has alone put a great obstacle in the operator's path upward, by requiring a larger number of men in other departments who are fit for promotion; and when by reason of the increase a road is changed from single track to double, the telegraph department at once loses a large part of its importance. The telephone has an influence in the same direction by reducing the importance of the operator's long term of education. A telephone operator needs but little training, and it is increasingly easy to get along without the telegraph for a day or a week, or permanently, according to the nature of the business. The telegraph being of less importance, has received less attention; less effort has been put forth to secure the best men for it and salaries have suffered.

But whatever may be the cause of the real or alleged deterioration, the telegraph superintendent who wishes to bring his department to the highest efficiency can only take the situation as he finds it. As long as operators are required to receive and deliver train orders according to the standard code, the service needs as high a standard as ever it did. If operators resign too rapidly, the head of the department is bound to demand the money to pay them better salaries; unless he is able to find another kind of man—one who is fully competent to fill the telegraph position, but does not possess the knowledge or ambition to get a better place in some other business. If the telegraph superintendent's demand for increased salary appropriations is "turned down" what shall be the next step? Surely, the telegraph department cannot wash its hands and wait for the general manager to make the next mention of the subject. The demand must be repeated. The tact necessary to do this at the right time and with the right degree of urgency is not taught in editorials—or in any other specific place—but it is up to the telegraph superintendent to acquire it, nevertheless. How else can he have a clear conscience when some dull-witted or inexperienced operator lets a couple of trains run together and kill some passengers? Perhaps one of the best ways to keep your general manager fully alive to this question is to see that he knows all about the collisions which are reported in the public press every month as due to operators' mistakes and negligence —and is reminded how many operators of that same kind he has on his own road!

Where the block system is in use and is rightly managed, the duty of handling despatchers' orders at once becomes less exacting, as a mistake in sending or receiving, or a failure to deliver, is not sure death to two or three trainmen, as so often is the case under the old plan; but is there, then, no call for improvement in the telegraph department? It must be admitted that at hundreds of stations the business appears to be accomplished, in some way or other, by operators who are poor senders, who make mistakes in receiving, though they take at a snail's pace; who do not understand the switchboard, and who make little intelligent effort to please the public. If a general manager is satisfied with that kind of service, or with the work of boys who, though bright, have a great deal of the knowledge of their business yet to learn, he will of course be hard to deal with; but the telegraph superintendent still is bound to preach to the management his ideal telegraph service, in season and out of season. As long as operators have to deal with the public it seems incongruous to take less pains to make them courteous and attentive to patrons' wishes than is taken with brakemen or gatemen. As long as they handle officers' telegrams why should not they be as alert and well trained as the stenographer or the private secretary?

In short, the telegraph department needs to be brought to a higher standard, not simply from the standpoint of the scientific or mechanical requirements which are peculiar to it, but because all of the functions of the station operator (who so often is the sole or most intelligent representative of the road in his town) are important. His work has to do with profits directly; with attracting custom, which, well or ill done increases or decreases income, and with the safety of lives, limbs and property. If the telegraph were abandoned to-morrow and all orders were to be sent by telephone, an equally good grade of intelligence would be needed. If written and repeated orders were abolished and collisions were prevented by the block system, the most active person at the small station would still have to be a high-grade man, to do the work of such a station properly. A specific complaint, both in the St. Louis paper and at the Indianapolis Convention, was that operators cannot patch wires. Such a deficiency, where it exists, indicates, probably, both neglect on the part of the superintendent or lineman who ought to teach the operator, and lack of ambition and enterprise on the operator's part. Whatever the cause, the means of cure is plain; and it is to be observed that this particular detail of the problem would not be materially changed by abandoning the telegraph and dismissing the telegraph operators, for the telephone would need the same kind of attention. Electrical communication would be an important feature of the railroad service, even if meeting points were made automatically.

The telegraph department of most American railroads holds a rather inconspicuous position. As with the signaling department, it may be that this lack of rightful importance is in some cases due to the modesty of the man at the head of the department, but the result is the same whether a man hides himself or is hidden by some one else. In the early period of the telegraph—say, from 1844 to 1874—the problems of invention, organization and expansion attracted many strong men to the service, but in the quiet times since then not so many of that class take to the telegraph. They find more congenial work elsewhere, and the department is overshadowed by others. Separating the railroad work from that of the telegraph company seems to have helped to produce this result. But whatever the relative position of the department, its work is important and should be made as perfect as possible.

Most of what we have said in the foregoing paragraphs will be taken, perhaps, as an argument for the improvement of the telegraph for the benefit of other departments; telegraph operators ought to be improved because better talent is required for the non-telegraphic duties which they perform. But if any telegraph superintendent feels aggrieved at this, we reply that this is our way of trying to aid him to increase his own importance!

THE COLORADO DISASTER.

The disaster by flood, at Eden, Col., last Sunday night, seems likely to prove the worst passenger train wreck that ever occurred in the United States, measuring by the number of lives lost, for the largest number of deaths ever before recorded was 85, at Chatsworth, Ill., in August, 1887. But there were over 200 injured in that wreck, whereas the number injured at Eden was very small. At Ashtabula, in 1876, there were 80 killed and 60 injured; at Laurel Run, last December, 65 killed and only 4 injured. At Armagh, Ireland, in 1889, the killed numbered 80 and the injured 262. In the Tay Bridge disaster in Scotland, in 1879, every one of the 73 persons on the train was lost. Larger losses have been reported from Mexico (1881, bridge disaster, 214 killed); Salvador (1894, 200 killed); Japan (1895, 140 killed), and Switzerland (1891, 130 killed). In circumstances the Colorado disaster is much like those at Thaxton's, Va., in 1889, and at McDonough, Ga., in 1900, in both of which cases passenger trains were wrecked as a result of sudden rains of great violence. At Thaxton's a roadmaster was on the engine, and the superintendent was in the baggage car, but the surface of the embankment gave no hint of its inner weakness. At McDonough every person on the train, except those in the rear car, was killed, and those parts of the wreck above the flood were burnt up so quickly that no help could reach the victims.

Whether or not there was any error of judgment at Eden cannot be discussed without a full account of the circumstances; and important details may never be known. The lesson for the future, so far as any lesson is discernible, is not so much one of judgment as one of courage. Cases will arise where an engineman, or the conductor and the engineman together, having no civil engineer or bridge expert at hand, must decide whether or not to cross a bridge of doubtful stability; and the practical question in such cases is quite likely to be, Have we the firmness of will to detain a train load of passengers an hour, or a night, when by minimizing the grounds for suspicion, or by trusting to the vigilance of trackmen whose whereabouts is not known, the train could in all probability be taken through on time? We are not saying that conductors and en-

ginemen consciously and designedly run into danger, even slight danger; but flood disasters which would have been prevented by the rigid caution which the rules require, do occur occasionally, calling attention to the need of consideration of the subject. Such a disaster occurred in Ohio a few months ago, not, however, to a passenger train.

The daily newspapers will call for the employment of track walkers every hour on every railroad. It seems heartless to answer that such a remedy would be too costly, and yet cost is the final arbiter. The wages of a track walker may be only a straw, but a straw may break a camel's back. Restriction of speeds at all times to 10 or 15 miles an hour would prevent a large share of the fatalities from bridge disasters, but the public would reject such a remedy; the people themselves would be glad to step in and deliberately risk their own lives if the railroad company were too cautious. Moreover, some cases would occur even if conductors stopped and examined every threatened bridge. Another demand that will be made will be that railroad tracks always be built high enough and waterways be made wide enough to provide for any possible rainfall or thaw. Here again we encounter the cold argument of cost. If we waited for perfect safety many railroads would never be built. The utmost provision against floods that can reasonably be taken in laying out and building a railroad is to carefully and intelligently provide against those which are liable to occur; and if the engineer puts an extreme construction on the word "liable" he may easily make unreasonable expenditures to guard against dangers that will never happen.

What can be accomplished by skilful retrenchment in the face of decreasing gross earnings is well shown by the comparison of earnings and expenses of the Pennsylvania system for the month of June, 1904, as compared with June, 1903. Taking as the five principal divisions the lines directly operated by the Pennsylvania Railroad Co., the Philadelphia, Baltimore & Washington, the Northern Central, the West Jersey & Seashore and the Lines West of Pittsburg and Erie; in two of the cases, that of the P. R. R. and of the Lines West, gross earnings decreased to a total of over one and a half millions, while on the three lesser divisions, although gross earnings increased as compared with June, 1903, the aggregate increase amounted to only about $76,000. But in place of the increases in operating expenses which were so alarming all last winter and spring, the cost of working was so materially reduced that the aggregate net earnings of the system for the month were $440,300 greater than in June, 1903. This is good railroading.

The Marienfelde-Zossen Electric High-Speed Trials.

Mr. Alexander Siemens on May 26 read a paper before the London Institution of Electrical Engineers on the high-speed electric railway experiments on the Marienfelde-Zossen line. The paper, in abstract, is printed elsewhere in this issue. In introducing the subject he gave an account of the work of Siemens & Halske since 1886, which led up to the Gross Lichterfelde experiments with a three-phase railway working with overhead conductors in 1898, and eventually to the work of the Studiengesellschaft on the military line between Zossen and Marienfelde in 1901, 1902 and 1903. He gave the rules and regulations which had to be observed during the trials, and having detailed the real object of the investigations, proceeded to bring out the chief results which are of value, by means of comments upon the reports issued by the Studiengesellschaft, together with some interesting curves of speeds, air resistance, energy consumption, etc. Mr. Siemens said that the construction of the conductors and collectors has solved the problem of how large quantities of electrical energy can be transferred from a standing conductor to a rapidly moving car, for the cars ran "steadier at a speed of 120 to 130 k.m. per hour than an ordinary corridor train carriage at 90 k.m. per hour." One of the cars had its ends with the corners well rounded, while the other had ends truncated cone shape. In the first trials the syndicate could not determine which of these was the better, but in the second trials they came to the conclusion that the front of the car should be a rather steep paraboloid. Owing, however, to the necessity of arranging the cabin of the driver in front and providing buffers and drawbars, it is not possible to carry this out in practice, but the nearest approach to the correct form is suggested to be a cylindrical front extending for 86 deg., then plain surfaces which join the sides of the car by easy curves.

When the trial runs of the high-speed cars were completed, some further experiments were made with a Siemens & Halske three-phase locomotive, and these are commented upon in a separate report of the syndicate. Here it is said that the high-speed cars have proved suitable for their work as far as their mechanical and electrical outfit is concerned, but their weight is too great and the proportion of the dead weight to the paying load is not favorable. This weight caused permanent way troubles, and also necessitated very high power during the acceleration period, and for economical high-speed traffic it should, if possible, be diminished so as to load the axles only sufficiently for the necessary adhesion. Mr. Siemens said further that it would not be possible to effect this object by altering the construction of the car, or by lightening its mechanical outfit, without endangering its safety; it is therefore necessary to try to diminish the weight of the electrical apparatus. This may be done by removing the transformers from the car and placing them along the line, or by dispensing with them altogether. In the first case a double set of conductors is required, increasing the losses and the capital expenditure. "It is therefore preferable to employ motors which are capable of utilizing high-tension currents." In order to try the possibility of using such motors on the high-speed cars, Messrs. Siemens & Halske built two motors of approximately the same outside dimensions, but suitable for working with 10,000-volt currents, and fitted them each to a four wheel track with a wheel base of 3.25 in. The car body, 12.5 m. long, was of the usual type for electric locomotives. It was found that the efficiency of this locomotive was much greater than that of the cars at the earlier trials, for the reason that its motors were working nearer to their rated output. Another reason was the absence of a transformer. The losses in the conductors along the line are given as 2 k.w. in the case of the locomotive, and 17 k.w. in the case of cars. It is contended that the experiments have afforded proof of the possibility of building motors for three-phase currents of 10,000 volts, used direct without transformers.

Railroad Gross Earnings for June.

Notwithstanding the fact that railroad gross earnings for June show a decrease over the same month last year, the returns as a whole are encouraging. For the month of June, 88 railroads report a decrease in gross of only $1,410,787. In May the decrease shown by 81 railroads was $2,811,823, and in April 72 roads reported a decrease of $2,771,810. This shows that gross earnings are slowly picking up, while at the same time operating expenses have been materially reduced. Of 60 of the more important railroads reporting gross earnings for June, 29 show increases and 31 decreases. Moreover, the decreases are confined to certain sections, and are not general throughout the country. Returns from the south, southwest and middle west all appear quite favorable. In the middle west the gains are due largely to the extra travel arising from the St. Louis Exposition, which has not been felt until now, as the fair was opened too late to affect the May earnings.

The factors which have worked toward the decrease of gross earnings in June are mainly the same as those which operated in May, i.e., the coming presidential election making trade very quiet, labor troubles in Colorado and heavy rains in certain sections of the west. The only difference lies in the fact that whereas in May the weather was bad in the Southwest, in June the effect of the inclement weather was felt mainly in the Northwest. Gross earnings when divided geographically clearly show the effect of the rains, as the greatest decreases have been among the Northwest and North Pacific railroads. In this group 14 roads report a decrease of $1,246,483 for the month of June. Earnings of the trunk lines have also been unsatisfactory, seven railroads in this group reporting a decrease of $1,412,883. On the other hand fairly heavy gains were scored during the month in the other groups. These may be summarized as follows: Southwest and South Pacific group (nine railroads), increase $1,053,469; Middle and Middle West group (15 railroads), increase $107,844; Southern group (14 railroads), increase $196,309. Owing to the fact that several of the railroads belonging to the Anthracite group have not reported their earnings for June, the showing may yet be materially bettered.

Among the separate railroads reporting earnings for the month, several show considerable gains. The most noteworthy of these are as follows: Atchison, Topeka & Santa Fe, increase $629,861; Wabash, increase $323,383; Missouri, Kansas & Texas, increase $312,741; Missouri Pacific, increase $265,000; and Illinois Central, increase $260,354. In contrast, the following important railroads show losses: Baltimore & Ohio, decrease $455,538; Great Northern, decrease $427,304; Chicago & North Western, decrease $416,172; New York Central, decrease $354,718; and Northern Pacific, decrease $204,180. As noted elsewhere in this issue, the Pennsylvania also shows a considerable decrease in gross earnings, amounting on its lines east to $1,050,300, and on the lines west, to $574,500 but the curtailment of operating expenses has been so successful that net earnings for the month show an increase of $440,300 for the entire system.

NEW PUBLICATIONS.

American Trade Index, 1904, 703 pages 5½ x8½ in. Printed by the National Association of Manufacturers, 170 Broadway, New York. Price in the United States, $5. The present volume is the sixth edition of the American Trade Index first published in

1899, and contains the names of about three thousand American manufacturers. The book is printed in English, German, Spanish and French, and its prime object is to acquaint the importer and dealer in foreign countries with the manufacturers in the United States of all classes of goods suitable for the export trade. The present edition comprises 12,000 copies, of which 7,500 are for foreign distribution, and this distribution is gratuitous to prominent importers, mostly dealers and manufacturers in countries outside of the United States who are interested in purchasing or handling American goods. The companies included in the book are indexed in four languages in the back according to the class of goods they manufacture.

Train Rules and Train Despatching, by H. A. Dalby. New York: The Derry-Collard Company. 221 pages, 4 in. x 6 in., flexible leather. $1.50.

This little book is called "A Practical Guide for Train Despatchers, enginemen, trainmen and all who have to do with the movement of trains." Mr. Dalby is a despatcher of long experience, and he always deals with his subject in a practical manner. About 100 pages contain the substance of the work, the rest being taken up with the standard code and illustrations, etc. Among the chapter headings are: Work Trains; Change of Timetable; Train Registers; Clearance Cards; Identification of Trains; Words to Operators; The Despatcher, Engineman and Trainman; Suggestions to Young Despatchers, etc. The author notices the electric train staff and gives colored illustrations of various kinds of signals, including the right-angle semaphore used on the Lake Shore & Michigan Southern. The book contains a reprint of the standard code, a list of dividing points for standard time, and some original illustrations showing the colored flag and lamp signals used on the front and rear ends of trains. The style of the book can best be shown by an extract. Giving "suggestions to young despatchers" the author says:

"On the average road, I believe the hours of the night, when only a few telegraph offices are open, are the hardest for the despatcher. A freight train leaves an open telegraph office and cannot be expected at the next one for several hours. The despatcher should provide such a train with help on superior trains, not only to cover the time it may reasonably be expected to 'come out of the dark,' but to provide for probable or possible delays. Suppose an extra leaves a station at 1 a.m. and should have plenty of time to make the next open telegraph office for No. 6, which is due at 2:45 a.m. If he knows that No. 6 is to be 30 minutes late it is wise to give the extra that 30 minutes. He may 'fall down' and the 30 minutes may save him two hours. Under the same conditions, if our extra is not important and an extra in the opposite direction is of such a character that we do not want to run the risk of a serious delay, our second named extra should have right over the first with 'wait' orders at such stations as may be of use to the extra of lesser importance. 'Meet' orders between trains of unequal importance should only be given when all telegraph offices are open and conditions are such that, in the event of unexpected delay to the inferior train, it can be reached and the order changed.

"It is very seldom that I should use a 'meet' order between passenger and freight trains, though the freight train may be of so great importance as to warrant taking the risk of holding the passenger train by making the time order three or four minutes longer than the anticipated actual time. Between freight trains, even of varying importance, when all telegraph offices are open, and there is a reasonable certainty of being able to hold the inferior train in case of unexpected delay, I believe the 'meet' order is by far the best. . . . But there are times when the 'meet' order would involve considerable risk of delay to the superior train. An unimportant train reports 'ready in five minutes.' All he has to do is pick up one car. But that car is at the other end of the yard where the train is beyond reach of the despatcher in case an unexpected delay occurs. A 'time' order is the proper thing in this case, if the superior train is of much greater importance."

TRADE CATALOGUES.

The Curtain Supply Company, Chicago, has issued a new catalogue, D, covering car curtains, curtain fixtures and curtain materials. It is 25 per cent. larger than the previous catalogue and is quite complete. The various types of fixtures are shown in the first pages and are described and illustrated in detail. The Forsyth adjustable roller tip fixture, which is widely used by railroads and traction companies, is fully described on pages 11 and 12, two detail sectional views being shown. The various styles of pinch-handle automatic, flap and vestibule door curtains follow, and the last pages show half-tone engravings of a few of each of the different kinds of curtain materials carried in stock, and contain directions relative to the different mechanisms and methods of hanging the curtains.

The Niles-Bement-Pond Company are distributing an exceptionally fine number of their *Progress Reporter*. The object of this publication is to keep the employees of the company, and the public generally, informed as to the new machines and devices which are constantly being brought out. The current issue is the Louisiana Purchase Exposition special number, and it illustrates the company's machines which are on exhibition at St. Louis. All of the machines shown are of new design, and a number of the larger machines are shown driven by direct-connected motors.

The Knowles Steam Pump Works, 114 Liberty street, New York City, has just issued their bulletin K—73, which describes their recently designed "Express" pump. This pump is of the reciprocating type and is direct connected to a motor. The 250-gallon pump runs at a speed of 300 r.p.m. The details of a test are given in which this pump showed an efficiency of 93 per cent. The pumps are made with capacities of from 200 to 4,000 gals. p.m. and for heads from 100 ft. to 2,000 ft.

The Standard Paint Company, New York City, has just issued its July number of "The Exchange." This is published monthly and is devoted to the interest of the Standard Paint Company. The company says that so far this year sales of Ruberoid roofing are largely in excess of those of last year, and that during the last three years the Government has ordered 3,500,000 sq. ft. A great deal of this was used in the Philippines.

The latest number of *The Little Blue Flag*, issued at intervals by The Lowe Brothers Company, Paint Makers, Dayton, Ohio, contains some interesting and instructive information for paint men and good advice on several subjects. There are also some attractive half-tone engravings of exteriors and interiors finished with the products of the publishers.

The Electric Storage Battery Company, Philadelphia, Pa., sends its July Bulletin, No. 84, which treats of the installation of the company's "Chloride Accumulator" in residential lighting and power plants. The pamphlet is illustrated throughout with photographs of battery rooms of well-known residences.

The Cleveland Twist Drill Company, Cleveland, Ohio, has just issued its 1904 catalogue. This company was established in 1874 and their product includes twist drills, reamers, taps, mills and cutters for all purposes. The catalogue is well illustrated and gives the prices and sizes of the various tools.

The Blaisdell Machinery Company, Bradford, Pa., has issued Bulletin No. 12, relating to self-oiling air compressors. A cross-section showing the general design of the compressor is shown. This is followed by a full detailed description of the separate parts and illustrations of the same.

The Standard Truck and Forging Company, St. Louis, Mo., sends an illustrated catalogue descriptive of its goods. This company makes a specialty of electric railway trucks, railway truck supplies, blacksmith tools, etc. They also make forgings to order.

Passenger Terminal at Long Island City.

[WITH AN INSET.]

At the enlarged passenger terminal of the Long Island Railroad, at Long Island City, New York (across the East River from Thirty-fourth street, Manhattan), the Union Switch & Signal Company has erected the largest electro-pneumatic interlocking machine, but one, that has ever been made; and it is in a tower four stories high, the machine being in the fourth story. The Vernon avenue bridge, crossing the tracks above grade, adjoins the tower (on the left in the illustration) and this made it necessary to raise the operating floor to an unusual height. The yard also is very long, the most distant switches being about 1,700 ft. from the tower.

The introduction of power interlocking at this place is part of a general improvement, which includes the entire rebuilding of the tracks in the yard, and the enlargement of the terminus for the accommodation of summer passenger business. The tracks have been increased 50 per cent., and most of them lengthened. The concourse has been doubled in size and the platform space increased in nearly the same proportion. The longest platform will now accommodate trains of 18 cars. The head house, a two-story brick structure, which was badly damaged by fire a year and half ago, has been restored. The building has been made larger, though the waiting room is of the same size as before, the addition being used for express, mail and employees' rooms and other conveniences which before were in outbuildings that have had to be removed to make room for additional tracks. The number of gates is increased to correspond with the increase in the number of tracks and the enlarged concourse. In the old arrangement the switches leading to the platform tracks were worked by hand, the machine in the old interlocking cabin, which stood near the signal marked 26L on the diagram, having control only of those switches within about 600 ft. of the cabin.

The remodeled head house has metal and plaster partitions, metal-sheathed wood work, and, in the first story, a concrete floor. The new part of this building, which is on the south, is so designed that the whole of both old and new can be thrown together for a large waiting room, but this is not at present necessary, for the reason that throughout nine months of the year the en-

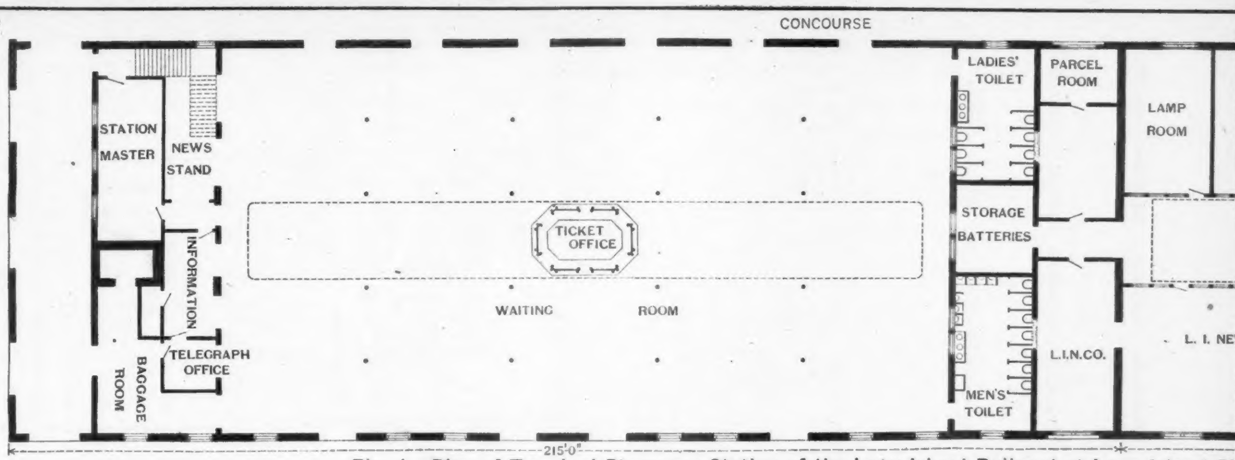


Fig. 1—Plan of Terminal Passenger Station of the Long Island Railroad at Long Island Ci

Exits from Concourse at extreme right and Left.

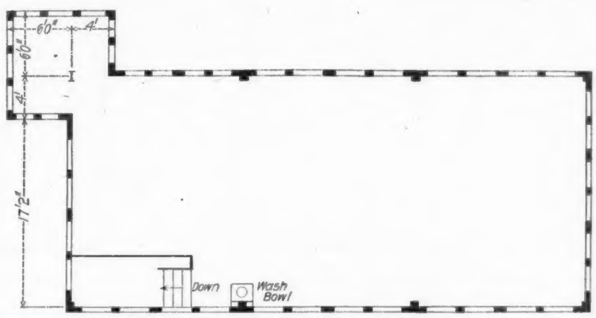


Fig. 12—Fourth Floor of Tower.

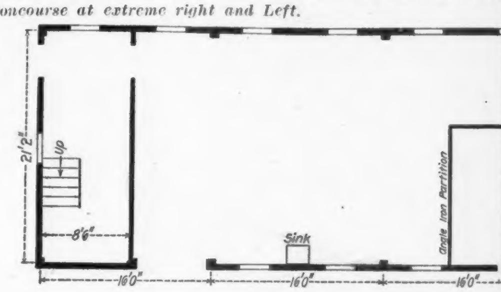
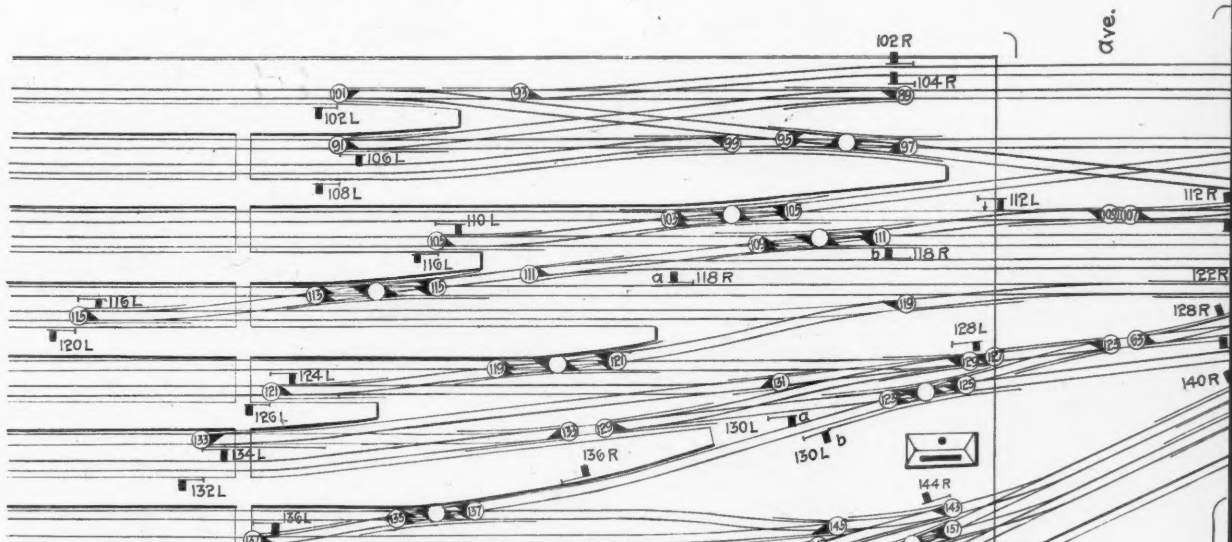
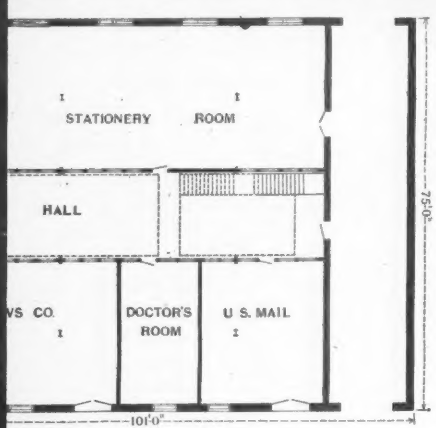


Fig. 9—First Floor of Signal Tower.





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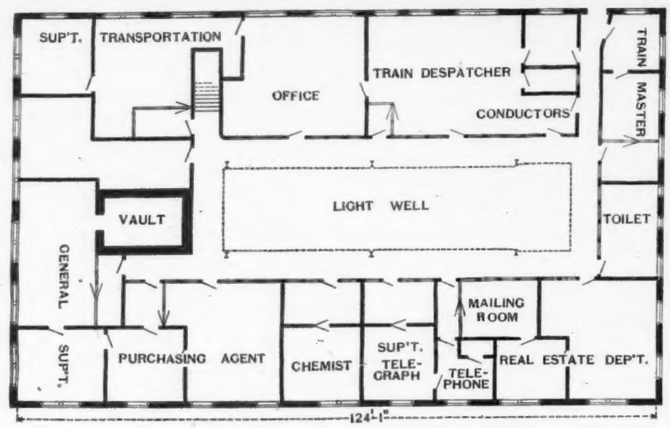


Fig. 2—Second Floor, North End.

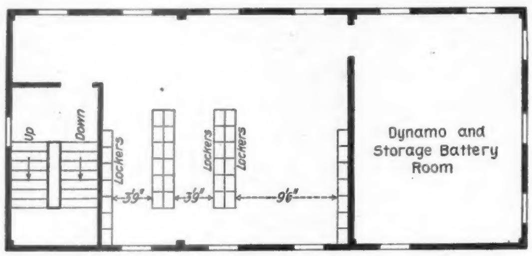


Fig. 10—Second Floor of Tower.

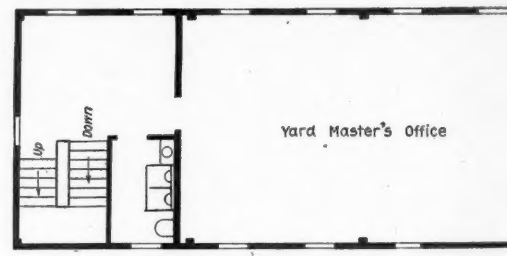


Fig. 11—Third Floor of Tower.

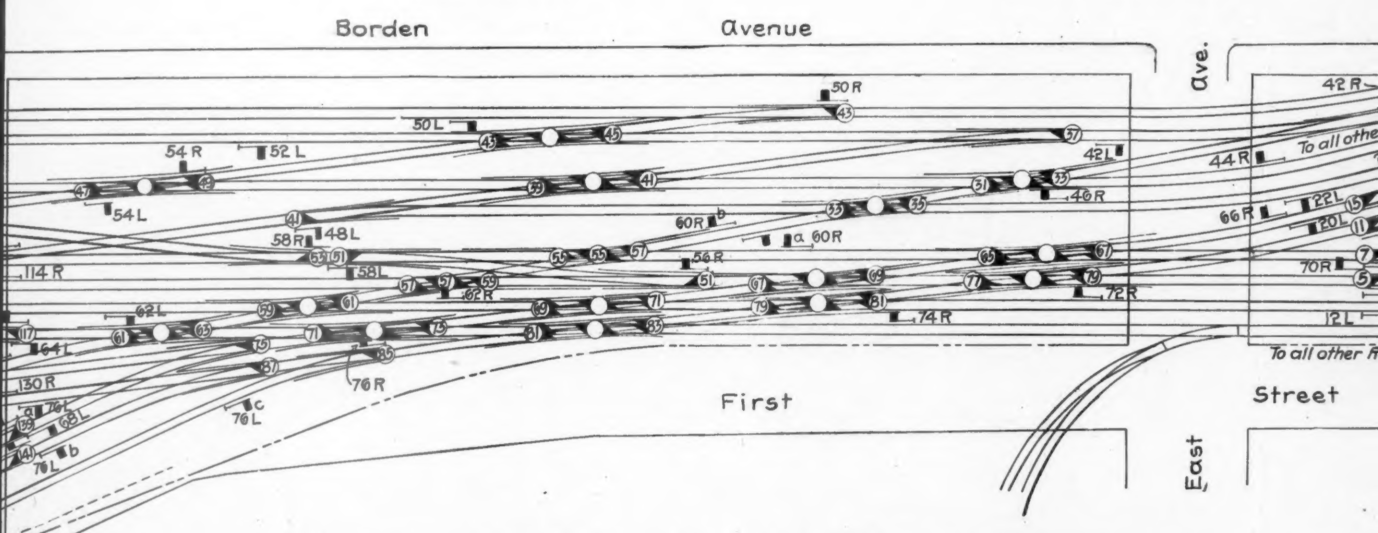


Fig. 6—Terminal Passenger Yard, Long Island Railroad, Long Island City, N. Y.—Westinghouse Elec

Approximate scale 100 ft. to the inch.

Fig. 4—Stationery Room.

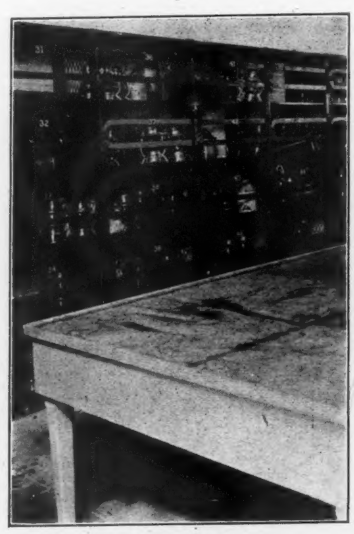


Fig. 5—Trainmen's Lamp Room.

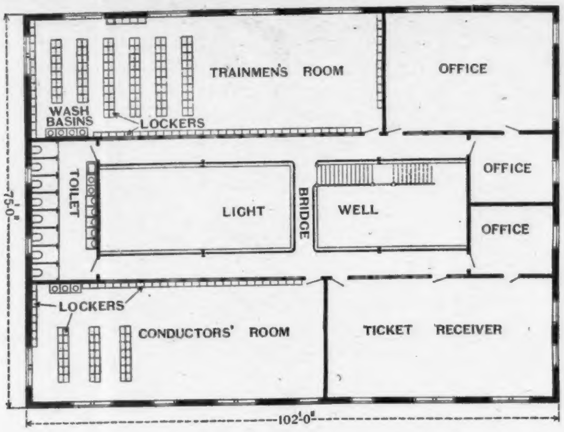
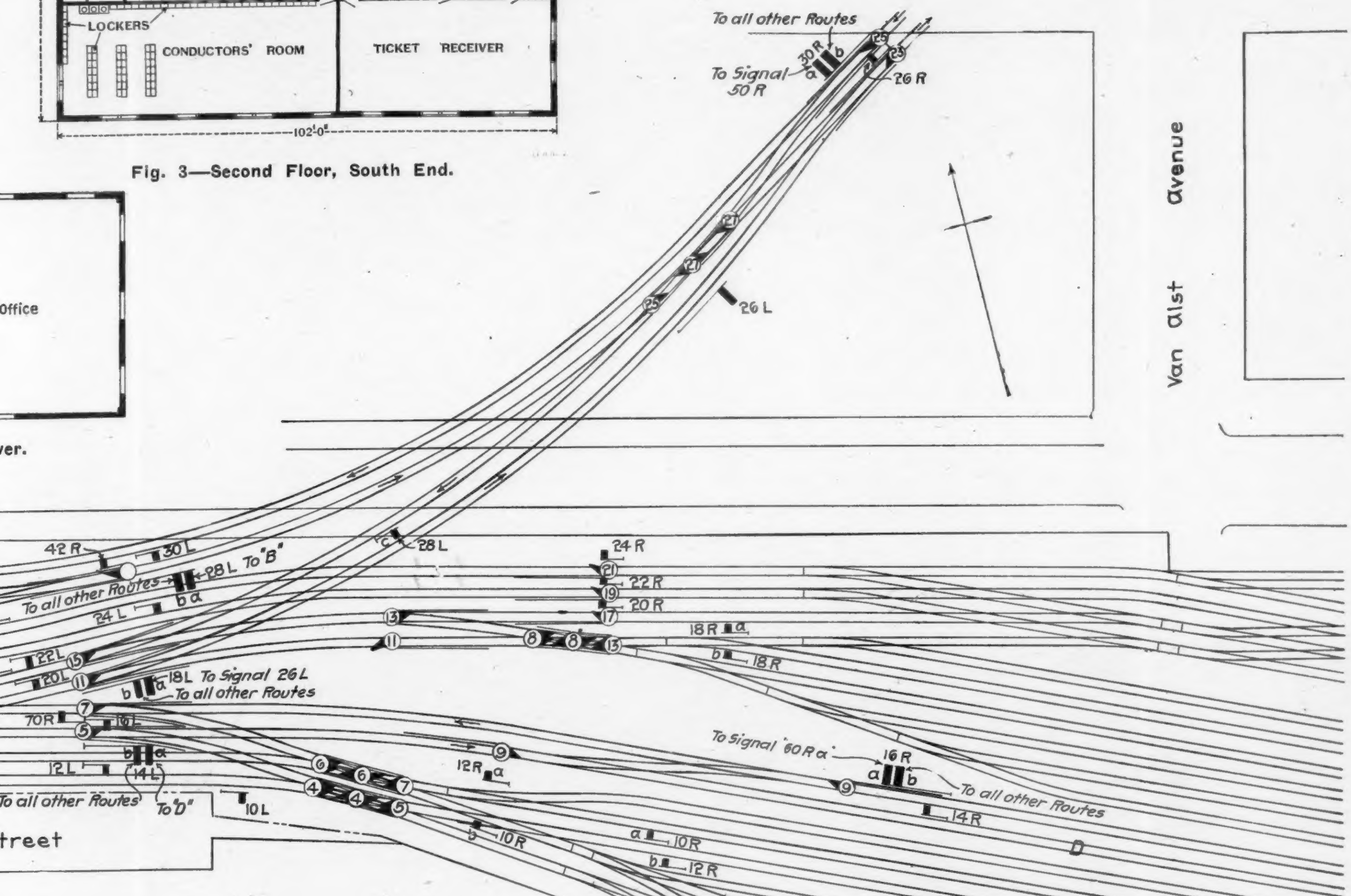


Fig. 3—Second Floor, South End.

The machine in the tower has spaces for 167 levers. Eighty-six levers work 56 single switches, 28 double slips with movable frogs, three single slips with movable frogs, and one bar; 56 levers work five standard semaphores with two arms each, one semaphore with a single arm, 76 dwarf signals, and 11 suspended signals. There are 25 spare spaces.



ver.

house Electro-Pneumatic Interlocking.

Fig. 7—Signal Tower.

tire business of this station is light; the heavy business occurs in the summer when the need of indoor facilities is at the minimum. The principal rooms in the addition are, on the first floor, a lamp room, a stationery room, a doctor's room, and rooms for the United States mail service and the Long Island News Co. Figs. 2 and 3 show the old and the new portions of the second story. It will be observed that the two plans of the second story are less in combined area than the first story. This is explained by the fact that a part of the building in the center is only one story high. The conductors' and trainmen's rooms have sheet metal lockers, 90 in the former and 172 in the latter. The racks in the stationery room are of sheet metal and strong wire netting, facilitating ventilation and cleanliness.

The lamp room, for the use of passenger trainmen, has 115 lockers designed especially for lanterns and flags. These lockers, as shown in the illustration, are made wholly of metal and yet are light and not costly. The door of each, a ⊂ shaped skeleton, is fastened by a padlock; and the openings in the skeleton are not large enough to admit of any of the lanterns or other things being taken out without unfastening it.

The sheds over the train platforms are of the inverted umbrella design, with drainage in the center, like those to be built at Washington, D. C., and described in the *Railroad Gazette* of Jan. 15 last, but they are of wood, with wooden supports and frames, and gravel roofs. The cheaper structure is more appropriate in this place, because in a few years the station may need extensive changes, by reason of the completion of the tunnel across the East River, which will take away a large part of its business.

The 185 switches and signals in the yard require 142 levers, as shown on the drawing, Fig. 6. The tower is 21 ft. x 48 ft., and the fourth floor is 35 ft. above the rails. The second and third floors are used for the purposes indicated on the drawing, and the first will probably be used as a shop. The projection, 10 ft. square (on the northwest corner) gives the train director a good view in every direction. The frame of the tower is of steel. The outer covering is of galvanized iron which, it will be seen, had not received its final coat of paint when our photograph was taken. The partitions and floors are so protected by plaster and by the use of metallic lath as to make the building practically fireproof.

There will be indicators in the tower connecting with buttons near the passenger gates at each one of the twenty-three tracks in the station. Conductors of trains about to depart will, by this means, notify the tower, and the man in the tower will in response advise the conductor when the route for his train is being set up.

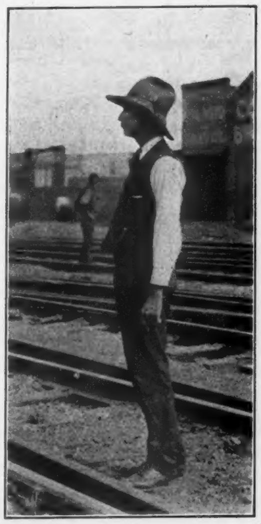


Fig. 8—Wireless Interlocking.

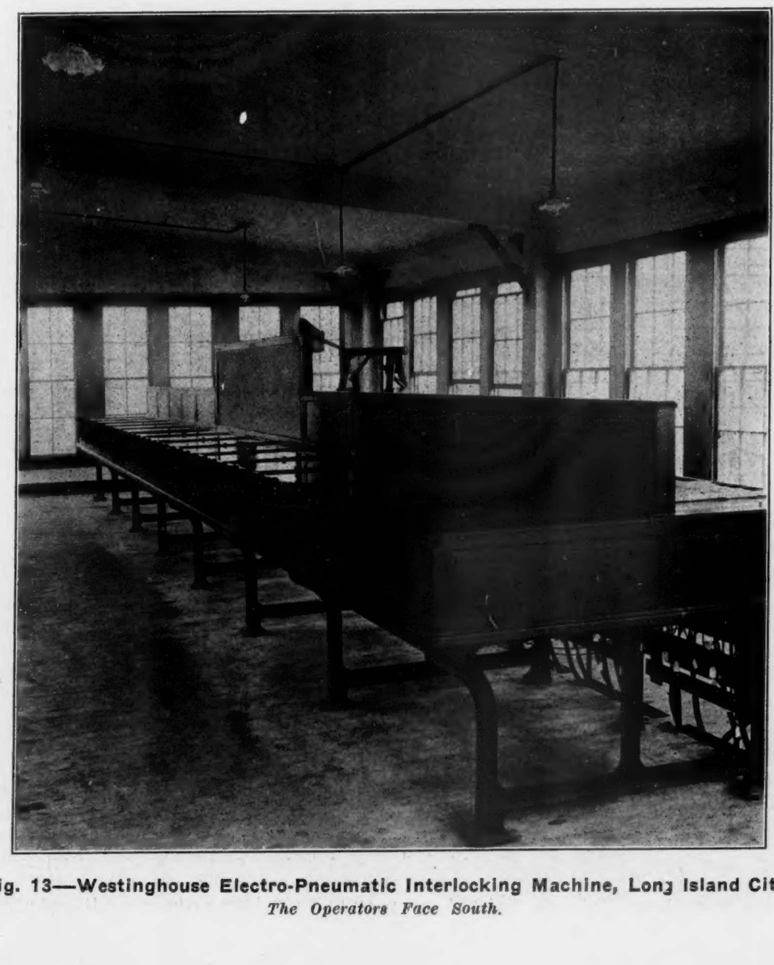


Fig. 13—Westinghouse Electro-Pneumatic Interlocking Machine, Long Island City.
The Operators Face South.

In those cases, in this yard, where switches are very close together, as in the case of No. 6 slips, such as 153 and 155, a single detector bar is used for the two switches, the connection to the bar being arranged so as to be worked in connection with either switch. The movement is arranged on the principle of a floating lever. The movement of either switch moves the bar for half its stroke; the movement of both switches moves the bar a whole stroke. By the use of the motion plate principle in the bar supports, the effect of a half stroke on the bar is practically the same as a whole stroke. With this arrangement, the bar is governed entirely by positive motions, no dependence being placed on gravity.

In consequence of the large number of switches in this yard in proportion to the number of signals, some of the upper levers in the machine are made to serve for switches and it will be seen, therefore, that some of the switches, such as 4 and 6, have even numbers, the usual rule being to use odd numbers for switches.

Since this plan was made, two short spur tracks have been laid to the left of the tower. These join the platform tracks near suspended signal 136R, and that signal has been replaced by one set on the ground at a point beyond the end of the platform.

On the North Shore division, which enters this yard from the northeast, trains are run by the telegraph block system, but from signal No. 30 back to the first block station there will be a continuous track circuit, and this track circuit will give indications in the tower in the yard, so as to automatically announce the approach of incoming trains. These trains, when passing signal 30R automatically set the signal at stop behind them, and by another track circuit they will automatically clear the signal when near signals 30L and 28L.

The new switches, with all parts made to conform in design to 100-lb. rails, were completed and put in use some weeks before the cabin and power house could be made ready. The new rails and frogs being too heavy, to be thrown by hand, they were worked, until the new power and interlocking were in condition to use, by compressed air, but were individually controlled, a man being stationed at each switch, with a key to turn the air valve. The power was furnished by the air pumps of two old locomotives stationed at one side of the yard.

The interlocking during this temporary arrangement was neither mechanical nor electrical, but was wholly psychical, the "machine" being in the top story of the "structure" shown in Fig. 8. This expedient was a marked success. As the reader will readily imagine, from a glance at the diagram of tracks, and from the fact that about 400 trains use this terminal daily, involving two or three times that number of movements, the quiescent attitude in which this train-director here appears was never maintained by him for long at any one time. His job was a "hot" one, not only as measured by the intensity of the rays of the sun, beating down on his very appropriate hat, but also quite "hot" in the language of the caboose.

The design of this yard was largely the work of General Superintendent C. L. Addison, and the signal apparatus has been made and put up under the supervision of Mr. Sidney Johnson on behalf of the Signal Company, and Mr. E. M. Weaver, Signal Engineer, for the railroad company.

High-Speed Electric Railway Experiments on the Marienfelde-Zossen Line.*

Since September, 1901, three sets of experimental runs have been made with high-speed cars on the military railway between Marienfelde and Zossen, near Berlin, which had been equipped electrically for the purpose, and last autumn speeds of over 200 km. per hr. were attained. The War Office placed their single line between Zossen and Marienfelde at the disposal of a syndicate, and the President of the Imperial Railway office became its chairman. Each year the syndicate has published a report of the trials of the preceding year, and all the data given in this paper are taken from these official reports, unless another source of information is specially mentioned.

The permanent way of the military line consisted of rails weighing 33.4 kg. per m., placed on iron and partly on wooden sleepers, and its condition was such that no greater speed than 80 km. per hr. was allowed on it. In the first instance this was improved by relaying about 800 rails of 12 m. each, increasing the number of sleepers by 4,000 and adding broken stone ballast to the extent of 4,000 cu. m. This work was finished and the line, 23 km. long, ready for the trials on Sept. 3, 1901, when the official inspection was satisfactory. At the same time electric contacts, to be actuated by the wheels, were placed at 500 m. distance from each other all along the line, and a registering apparatus at Mahlow Station was connected to them, so that the speed of the cars could be verified there.

The overhead conductors along the line were constructed by Siemens & Halske, with a device to ground the line in case a conductor should break. At every insulator a metallic loop, about 30 cm. in diameter, extending horizontally toward the pole, is connected to the conductor, and a vertical copper wire passes through the center of the loops, the copper wire being efficiently connected to the running rails and through them to the zero point of the three-phase generators, the rails being in addition connected to metal earth-plates at intervals of 1 km. Any interruption of a conductor brings it, therefore, at once into contact with earth, and prevents any accident by shock from the falling conductor. The efficiency of this arrangement was tested, both intentionally and by accident, when the conductor fell on an official, but in both cases the grounding served as an absolute protection. The line is fitted at every kilometer with means of adjusting the strain, kept at about 1,000 kgs., and with lightning dischargers of the horn pattern. At a distance of about 1 km. from Marienfelde (km. 8.5) the feeding line from the generating station Oberspree, 13 km. distant, and built by the Allgemeine Elektrizitäts-Gesellschaft, is joined to the line along the railway by a main switch.

Two cars were built for the trials by Zypen & Charlier, constructed and fitted as corridor cars in accordance with the rules of the German Railway Union. One of these cars, called "A," was furnished with its electrical outfit by the A. E. G.; the other was fitted out by Siemens & Halske, and in the reports is called "S." There are two groups of three collectors on each car. These cars were delivered on the experimental line in the beginning of September, 1901, and at first were drawn by locomotives, so as to ascertain whether all their parts, especially the brakes and springs, were properly adjusted, and to study the mechanical behavior of the collectors and conductors. Observations were also made as to the relative movements of the bogies and the carriages.

The technical committee of the syndicate decided that the trials should be undertaken in such a manner as to ascertain: (1) The highest safe speed on the line; (2) the proper construction of the permanent way; (3) the most advantageous construction of the car; (4) the most suitable electrical outfit; (5) the amount of energy at the various

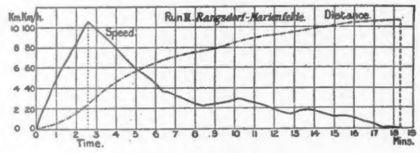
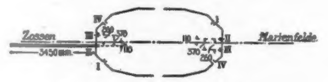


Fig. 1—Curves Showing Retardation of Car "A."

speeds; (6) the cost of working. To obtain the necessary data, each car has been fitted with the following instruments: (1) A speed indicator for the driver; (2) a speed-registering apparatus; (3) an acceleration indicator; (4) a voltmeter; (5) an ammeter; (6) a wattmeter; (7) a phase indicator; (8) a pyrometer; (9) air-pressure indicators.

The speed indicator registers the kilometers per hour, and is checked by the speed-registering apparatus on the car and by the instrument at Mahlow station,



Location of Tubes in Car.

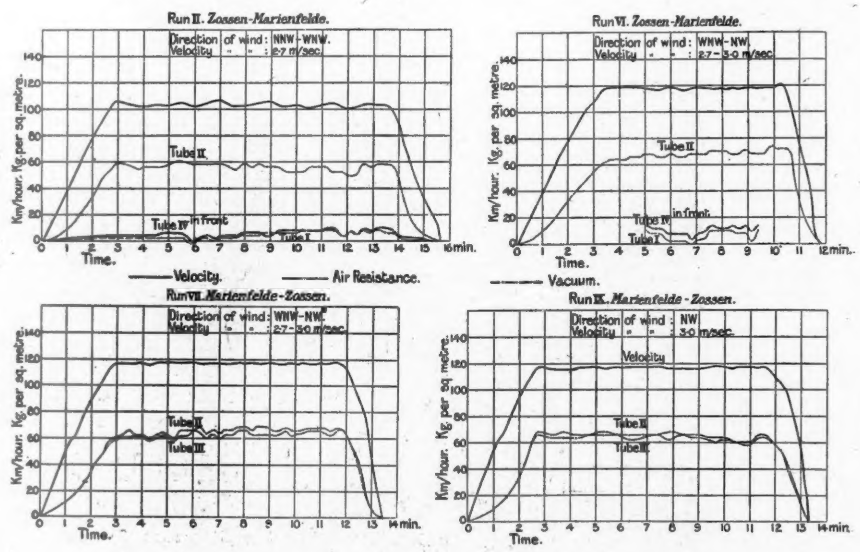


Fig. 2—Curves of Speed and Air Resistance of Car "S."

where the position of the car is indicated every 500 meters by the wheel contacts along the line. Of the greatest importance are the observations in connection with the brakes, both as regards the time and the distance taken to bring the car to a standstill after it had attained certain speeds. At the generating station in Oberspree, suitable instruments for registering volts and amperes were connected to the feeder, so as to check the apparatus on the cars.

On October 8, 1901, the "S" car made its first run between the car shed and km. 10.5, but while the current was on the signaling apparatus of the State Railway and of the Military Line were sufficiently affected to require the construction of metallic returns along the whole line. This was finished in time for the regular runs of both cars to commence on October 14.

During these trials the cars ran about 3,000 km., of which 2,200 km. were under current, and for 800 km. the cars were pulled by locomotives before any current was used. The first two sets of experiments were carried out according to programme, and dealt with speeds up to 130 km. per hr., and they were principally utilized to ascertain the rate of acceleration and the data of braking. During the third set the speed was gradually increased until the "S" car reached a speed of 160.2 km. per hr. on November 5, while the railway officials made an inspection of the line in accordance with the regulations governing the trials. Even at a speed of 140 km. the running of the cars became irregular owing to the condition of the permanent way, and at higher speeds the rails were bent and their lever was so much disturbed that the speed of the subsequent runs had to be restricted to 130 km. per hr. It was, however, possible to make valuable measurements of the energy required, and the working of the collectors and conductors could be observed with currents of 48 periods and 13,500 volts.

About the behavior of the various component parts the report of the syndicate enters into great detail, of which a short summary only is given. At the generating station the steam dynamo and transformers worked quite satisfactorily, and supplied current of 25 to 50 periods and 6,000 to 14,000 volts. The feeder consists of four conductors, each of 50 sq. mm. section, the fourth conductor connecting the running rails to the zero point of the two transformers. The conductors along the line, constructed as described above by Siemens & Halske, have given no trouble whatever even in heavy rain or hoar-frost.

One of the most important problems, namely, to ascertain how large quantities of energy can be transferred from a standing conductor to a rapidly moving car, has been successfully solved by the construction of the conductors and of the collectors, both of which were the outcome of the experiment at Gross-Lichterfelde. Both carriages, built by Van der Zypen & Charlier, ran in a very satisfactory manner, and ran steadier at a speed of 120 to 130 km. per hr. than an ordinary corridor train carriage at 90 km. per hr. At higher speeds the irregularities of the permanent way made the running dangerous. In the two articles mentioned above

*From a paper read by Alexander Siemens before the Institution of Electrical Engineers, May 26, 1904.

the electrical arrangements of the two cars are described in detail.

The report of the syndicate makes the following observations:

(*a*) It considers the switching arrangements of the "S" car more complicated than those of the "A" car, and suggests for both cars that it should be possible from either end to set both groups of collectors simultaneously.

(*b*) The transformers in both cars are cooled by air and have worked well during the trials.

In car "S," after running 230 km. in succession, necessitating 14 accelerations to a speed of 120 km. per hr., the temperature of the transformers was only 25 deg. C.; they were, therefore, considered sufficiently large to stand long runs, especially as they worked well with 12,000 to 13,000 volts. On the other car the transformers were much lighter, but they were never overheated, only on November 19 a primary coil was short-circuited by a current of 12,000 volts. After that date currents of no more than 8,000 volts were permitted, so that the point could not be settled whether the transformers on this car could be used for long periods with high voltages.

(*c*) Each of the motors on both cars is designed for 250 h.p., the "A" car motor taking current at 435 volts, and the "S" car motors 1,150 volts, while the pressure in the secondary circuit is 650 volts when standing still and during acceleration. No difference in running was experienced, although the motors on the "S" cars are rigidly fixed to the axles of the wheels, while the motors on the "A" car are carried by the bogie frame and drive by an arrangement of springs. The report prefers the latter arrangement, and suggests trying a third method—driving the wheels by connecting rods.

(*d*) The switches and resistances present another feature in which the electrical arrangements of the two cars differ; on the "A" car liquid resistances were employed, regulated by pumps, while metallic resistances were carried on the "S" car. Both arrangements gave no trouble during these trials. The metallic resistance switches are more complicated than the others, but they work faster. Of great importance are the results obtained while accelerating and during the retardation of the cars. The acceleration varied with the demand on the generating station and the motors, as was to be expected. To obtain a speed of 100 km. per hr. the distances traveled varied from 2,000 to 3,200 meters, and the times from 138 to 220 seconds. These figures correspond to an average acceleration of 0.13 to 0.2 m. per second, and correspond to 700-1,000 h.p. As the motors are capable of exerting up to 3,000 h.p. during acceleration, this might have been increased correspondingly, but the generating set was not powerful enough to supply the necessary current. For trains intended to travel long distances without stops the rate of acceleration is, however, of less importance than the action of the brakes on which the safety of the service depends. Both cars were fitted with a Westinghouse quick-acting brake, hand brakes and an electric brake acting by reversing the currents through the motors. The "A" car had, in addition an accumulator battery, the current from which could be sent through the three-phase motors. In Fig. 1 the decrease of speed is shown when the "A" car was left to itself after attaining a speed of about 106 km. per hr., respectively.

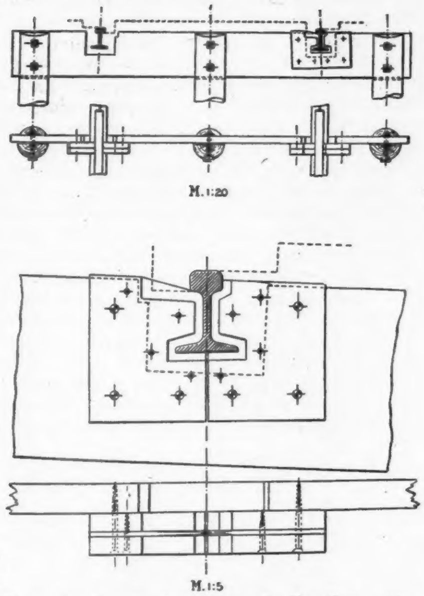


Fig. 3—Apparatus for Indicating the Movement of the Rails.

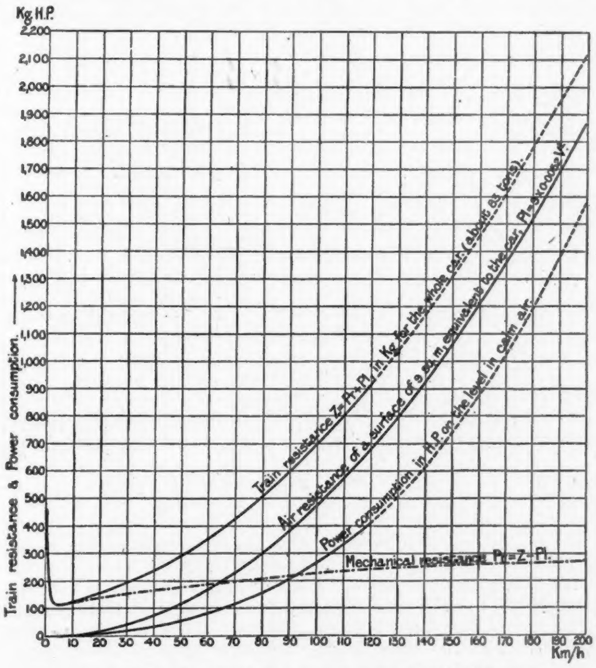


Fig. 5.—Train Resistance and Power Consumption of High-Speed Cars.

Very numerous observations were made about the consumption of energy both in the generating station and on the cars, especially during the last set of runs. For this purpose readings were taken at the switchboard in the generating station every 10 seconds of the volts, amperes and watts, and the periodicity of the current was checked by the number of revolutions of the generating set. On the cars amperes and volts were read at intervals of from 15 to 30 seconds. The measurements at the station were the most accurate, as the instruments there were not exposed to the vibrations unavoidable on the cars. After making the observations they had to be corrected, as the instruments were only correct at a certain periodicity.

Numerous further measurements were taken and Table 1 gives the average result of the power required at a constant speed:

TABLE I.—POWER REQUIRED AT CONSTANT SPEED.

Car.	Speed. Km. per hour.	B. H. P. Measured at feeding point.	B. H. P. Measured at car collector.	B. H. P. Calculated from speed.	Efficiency of electrical outfit. Car by itself. Per cent.	Efficiency of electrical outfit. Car and conductors. Per cent.	Consumption of steam. Kg. per B. H. P. per hour. At car wheels.	Consumption of steam. Kg. per B. H. P. per hour. At flywheel of steam engine.
"A"..	118	478	455	397	87	83	5.84	4.6
"S"..	115	431	405	341	84	79	6.12	

The report does not consider these figures reliable enough for commercial deductions, partly because the instruments were not properly calibrated for the varying periodicity of the current, partly because the motors in both cars were working very much below their rated output.

For the purpose of observing the air resistance at the various speeds openings were made in various parts of the car bodies and short brass tubes inserted. These tubes were connected by india rubber tubes to a row of pressure indicators consisting of pairs of communicating glass tubes about 5 mm. in diameter partly filled with water. An adjustable scale was fitted to each indicator divided into millimeters, so that the difference in the water level of the two tubes could be observed at the various speeds. Four such openings were made at each end of either car, two of which were near the center and the other two at the sides, as indicated in the diagrams of Fig. 2.

Preliminary trials proved that the position and the form of the opening of the brass tubes have no influence on the result, and this made it possible to compare the pressure all over the front of the car with the pressure in the center, independent of

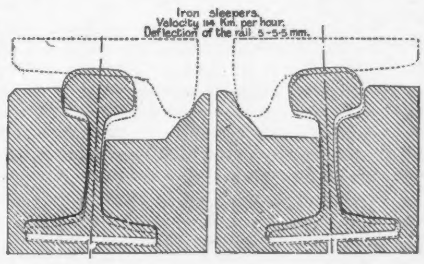


Fig. 4—Diagram Showing Displacement of the Rails at 15.8 Kms.

the varying speed of the car. In addition, straight tubes up to 3.4 m. long, were fitted to explore the pressure of the air in front of the car, and these observations showed that a cone of uniform pressure exists in front and at the back of the car, the apex of which was about 3 m. distant from the car. The "A" car, as the diagram shows, has well-rounded corners, while the "S" car has its ends in the shape of truncated cones. The pressure on these was very much smaller than in the center, and sometimes even negative owing to the influence of the wind. Some openings were also made along the sides of the car and occasional observations showed that speed had very little influence on the

pressure indicated, when the brass tubes ended flush with the sides of the car, and that the direction of the wind has much more effect.

Combining all the results the report considers that up to a speed of 150 km. per hr. the pressure may be calculated by the equation $p = 0.07\ v^2$, when v is the velocity in meters per second and p is the pressure on a surface of 1 sq. m., at right angles to the direction of the motion. The number of observations were, however, insufficient to determine to best form for the end of the cars. Another set of observations was made to determine the extent of the movement of the rails, when the cars were passing at various speeds. For this purpose measuring apparatus were set up at various points of the line, which are shown in Fig. 3. Each of these consists of three strong posts, about 1½ m. long, rammed into the ground, one in the center and one on each side of the rails, to which a strong board is fastened with its upper edge a little below rail level and with suitable openings cut to permit the rails to pass through. Near each rail two short boards are bolted to the plank, between which a lead plate is supported. This is cut in two and fitted accurately against the rail, the edges touching the rail being sharpened. It is evident that any movement of the rail will bend these edges back and thus leave a permanent record of the greatest movement of the rail. The result on one set of lead plates is shown in Fig. 4, and a summary of the principal observations is the following:

Distance between sleepers.		Material of sleepers.	Ballast Motor Cars.	Speed Km. p. h.	Depression of rails in mm.
800	mm.	wood	sand	108	2.0—2.5
850	"	wood	sand	114	3.5—5.0
780	"	wood	stones	145	6.0—6.5
780	"	iron	sand	114	5.0—5.5
780	"	iron	sand	135	6.0—6.5
730	"	iron	sand	123	6.0—7.0
Military Trains.					
850	"	wood	sand	70—80	1.5—2.0
730	"	iron	sand	70—80	4.0—

From these experiences the conclusion was drawn that the permanent way had to be thoroughly reconstructed before speeds exceeding 120 km. per hr. could be safely investigated. As the military trains run only at considerable intervals, at a comparatively low speed, the existing signaling apparatus had to be supplemented by distant signals about 2 km. from the stations, and some difficulty was also experienced in seeing sufficiently far ahead in rainy weather. It is, therefore, suggested to repeat the signals on the car by visual and by audible means, which should also indicate when the apparatus is out of order. In addition it is recommended to cut the current off in the sections which a car has just left.

In conclusion, the first report states that, thanks to the care exercised by the firms supplying the cars and outfit, to the cautious and reliable execution of all the electrical work, to the careful maintenance of the permanent way and its appurtenances, and to the conscientious observation of all the precautionary measures, no mishap or damage of any kind has occurred during the trials. No psychological effects on the drivers or passengers, attributable to the high speeds, have been noticed. Although it has not been possible to obtain reliable data for judging the economical aspect of this question, some valuable technical information has been gained. In the first place, the experiments have shown that it is possible to collect high-tension currents even in unfavorable weather from overhead conductors at double the speed of the present express trains. Both the conductors and the collectors have worked so satisfactorily up to the present that their efficiency at higher speeds may be safely assumed. Three-phase motors have shown themselves reliable, and their overheating has been prevented by suitable ventilation. It has, however, not been possible to decide whether it is preferable to fix the motor on the axle or support it wholly by springs; nor can it be safely said whether fluid or metallic resistances are the more suitable. The brakes have not been powerful enough for the high speeds. An alteration of the existing arrangements, and the adoption of an efficient electric brake appears to be imperative.

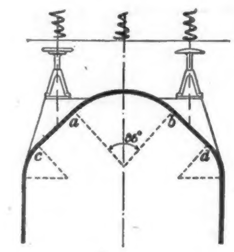


Fig. 6—Shape of Front of Car.

Generally speaking, the first year's trials have served principally to find out the best methods of making observations, and to determine which are the most suitable instruments for obtaining trustworthy information. Basing further experiments on the knowledge thus gained, it is certain that it can be ascertained whether the cars, their equipment, and all other outfit are suitable for regular traffic on main lines at a speed of 160 km. per hr. and whether still higher speeds are practicable, especially from an economic standpoint.

Originally it had been the intention to resume the experiments in 1902 on the lines laid down at the commencement, and to increase gradually the speed of the cars until a speed of 200 km. per hr. had been attained. It was, however, not possible to relay the permanent way in time, and in consequence of this the authorities would not allow a greater speed than 125 km. per hr. The time was, therefore, utilized for determining more accurately the resistance of the cars at various speeds, the power required for propelling them, and the losses of energy in the feeder and the conductors. In addition to this, further experiments were made with the brakes, and alterations in the structure of the cars were considered to insure steady running at high speeds; the movement of the rails was also observed during the trials.

The second report describes the experiments in great detail, and the following are the principal results ascertained by their help: At first attempts were made to determine the resistance of the cars direct by pulling them at moderate speeds by a locomotive, to which they were attached by a dynamometer. It was found, however, that owing to the great weight of the cars, and owing to the irregular pull of the locomotives, no steady curves could be obtained, nor was the success greater when the cars were attached to a goods train. Somewhat better results were achieved by the employment of a three-phase locomotive, but the curves were still too irregular to be accepted. Nothing remained but to revert to observing the time each car took to come to a standstill after attaining a certain speed, and the distance it covered during that time, due account being taken of all differences in level. The smallest curve on the line has a radius of 2,000 m.; it was therefore not necessary to consider the curvature in the calculations, but very careful measurements of the air resistance were made by means of tubes projected from the cars in the way already described, and in the end a small correction was found necessary in the formula for air resistance, which was altered to $P = .0052\ V^2$, and the resistance of the cars was found to be equal to the resistance of 9 sq. m.

In Fig. 5 the final results of the traction resistance of the cars are represented by four

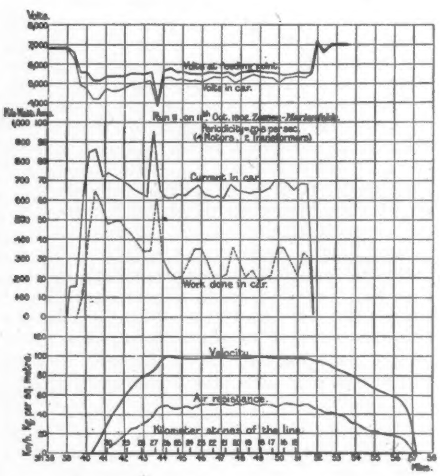


Fig. 7—Runs with Car "A."
Weight = 89,500 Kg.

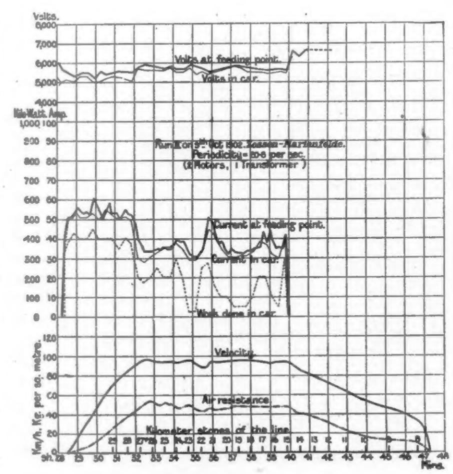


Fig. 8—Runs with Car "S."
Weight = 77,900 Kg.

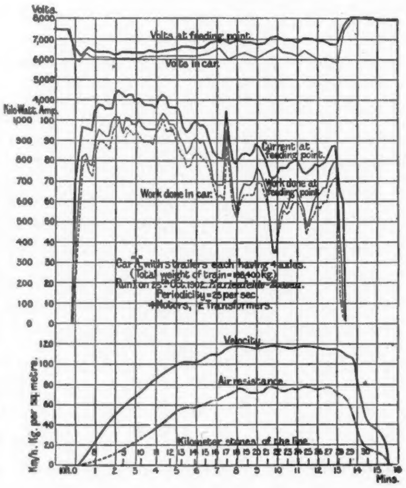


Fig. 9—Runs with Trailers.

curves showing the total resistance for a car weighing 83 tons, the air resistance of a surface of 9 sq. m. being the equivalent of the air resistance of a car, the h.-p. required on the level with no wind, and, by the difference of the first and second curves, the resistance due to mechanical friction. It is at once apparent, from this diagram, that at high speeds the air resistance is by far the most important factor, and that the proper shape of the car has to be very carefully determined.

From their experiments the Studiengesellschaft drew the conclusion that the front of the car should be a rather steep paraboloid. Owing to the necessity of arranging the cabin of the driver in front, and providing buffers and drawbars, it is not possible to carry this out in practice, but the nearest approach to the correct form is suggested to be a cylindrical front, extending for 86 deg., then plain surfaces, which join the sides of the car by easy curves, as represented in Fig. 6. Very careful measurements were made as to the amount of energy required, and a measuring station was established at the feeding point, to avoid the calculations of the losses in the feeder. The ammeter and wattmeter at this station were connected direct to the high-tension circuit, to avoid the use of transformers and to make them almost independent of periodicity and of difference in phase. In the cars the instruments were joined to the same phase as at the feeding point. In spite of all precautions, however, the readings were not all reliable, especially in wet weather.

The measurements are divided into two groups: one to determine the energy during acceleration, and the other to measure it at constant speed. In both cases the cars were sometimes running by themselves, and sometimes pulling trailing cars. It will be noticed that the acceleration is not very great, but this was the consequence of the generating set not being powerful enough to supply more energy. Compared with the theoretical amount of energy required to give the cars the same acceleration, the figures of the table show an efficiency of about 45 per cent., due, no doubt, to the losses in the starting resistances; but for long-distance traveling the period of acceleration is almost negligible.

In Tables 2 and 3 the results of these experiments are summarized, and diagrams in Figs. 7, 8 and 9 give some details of runs with and without trailers. An attempt was made to measure the turning moment of a motor direct by fitting on car "A" a special apparatus represented in Fig. 10. Instead of attaching the motor rigidly to the frame, it is held by springs, as shown diagrammatically, and the movement of the springs is transmitted by suitable levers to a registering indicator in the interior of the car.

The instrument was calibrated by weights, and gave useful results when a resistance was inserted in the secondary circuit of the motor, but of course the direct comparison between the indicated turning moment and the electrical readings is thereby prevented. Diagram V., Fig. 11, shows the turning moment during a run of car "A" on November 8. About the measurements made to ascertain the loss in feeders and conductors, nothing need be said, as no novel features with regard to them are disclosed in the report. Nor need the brake experiments be described, as they were again unsatisfactory, and eventually it was considered advisable to alter the whole of the braking arrangements. A good opportunity for doing this was afforded by the reconstruction of the bogies, which became necessary to ensure the steady running of the cars during high speeds.

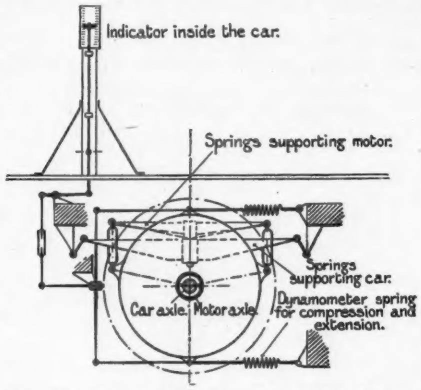


Fig. 10—Apparatus for Measuring Turning Moment.

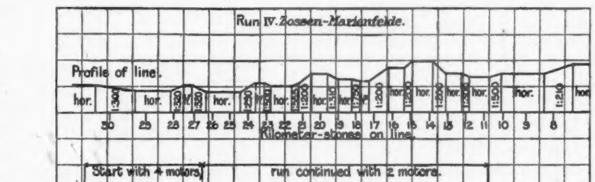


Fig. 11—Trial Runs with Car "A."

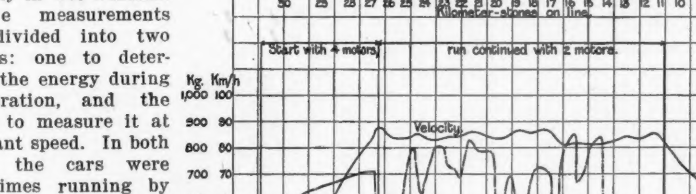


Fig. 12—Proposed Brake Arrangement.

In the new bogies the following points were to be observed: (1) The wheel base is to be increased from 3.8 to 5.0 m.; (2) the bogie frames are to be constructed with simple Z girders; (3) the bearing springs are to be connected by balancing levers, and are to be visible and easily accessible throughout their whole length; (4) the car body is to be supported at four points on each bogie; (5) the center pin of the bogie is to be movable for a distance of 30 mm. in every direction; (6) the motors are to be connected to the axles by springs; (7) the brakes are to be reconstructed as shown in outline by Fig. 12, which explains itself.

During the trials the bending of the rails was measured in the same way as in the previous year; but as the speed of the cars had been restricted, no extraordinary repairs became necessary.

When the trial runs of the high-speed cars had been completed, some further experiments were made with a three-phase locomotive built by Siemens & Halske, and the Studiengesellschaft comments on them in a separate report. In this case they say that the high-speed cars have proved suitable for their work as far as their mechanical and electrical outfit is concerned, but their weight is too great and the proportion of their dead weight to the paying load is not favorable. The trouble with the permanent way and the very high power required during the acceleration period were a consequence of this weight, and for economical high-speed traffic it should, if possible, be diminished so as to load the axles only sufficiently for the necessary adhesion. It would not be possible to effect this object by altering the construction of the car or by lightening its mechanical outfit without endangering its safety. It is, therefore, necessary to try to diminish the weight of the electrical apparatus. This may be done by removing the transformers from the car and placing them along the line, or by dispensing with them altogether. In the first case a double set of conductors is required, increasing the losses and the capital expenditure. It is, therefore, preferable to employ motors which are capable of utilizing high-tension currents.

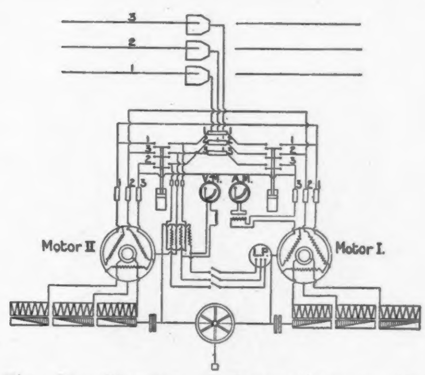


Fig. 13—Diagram of Connections to Air Pumps.

Pumps are shown at L. P.

With a view of trying the possibility of using such motors on the high-speed cars, Messrs. Siemens & Halske built two motors of approximately the same outside dimensions, but suitable for working with 10,000-volt currents, and fitted them each to a four-wheeled bogie with a wheel-base of 3.25 m. The car body, 12.5 m. long, is of the usual shape for electric locomotives, and in its center is a driver's cabin 4 m. long by 2.8 m. wide by 2.3 m. high. In the iron boxes on either side of it are the starting switches

and resistances, and on the top it carries the collecting gear, which is like that of car "S." The motors are suspended from the bogie frames after the manner of tram motors, driving the axles by a gearing of 1:2. Between the car body and the wheels are two sets of springs, and provision is made for a slight lateral movement relative to the bogie.

The diagram (Fig. 13) of the connections shows that there are separate switches, moved by compressed air, for each direction of running, a small transformer to supply low-tension current to the air-pump motor, and mechanical switches for the resistances which are actuated by a hand wheel in the driver's cabin, geared to a horizontal shaft.

Some difficulties were experienced in obtaining readings of the measuring instruments on the locomotive of sufficient accuracy, so that finally only the measurements at the feeding point were taken into consideration. The trial runs were started on June 23, 1902, with 7,250 volts, and this voltage was gradually raised until the locomotive successfully pulled a trailer on June 26 with just over 10,000 volts. Some of the details of the measurements taken during these runs are given in Table No. 4. It is at once apparent that the efficiency of the locomotive is much greater than that of the cars at the trials in 1901, for the reason that its motors were working nearer to their rated output. Another reason is the absence of a transformer, so that a comparison at an output of 400 h.-p. shows that the locomotive required for this at 10,800 volts, and an average current of 19 amperes, while the cars at 6,300 volts consumed about 53 amperes. The losses in the conductors along the line are therefore 2 k.w. in the case of the locomotive, and 17 k.w. in the case of the cars. In conclusion, the report considers that the trials have proved the possibility of building motors for three-phase currents of 10,000 volts, used direct without transformers. It is mentioned that the motors and the gearing have worked without giving any trouble.

TABLE II.—AVERAGE VALUE OF THE ELECTRICAL AND MECHANICAL MEASUREMENTS TAKEN DURING ACCELERATION.

No. of Runs.	Number of Motors Working.	Total Weight of Train in Tons.	Distance in Meters.	Falling Gradient Average P. C.	Average Acceleration m/sec.	Final Speed, km/hour.	No. of Periods per sec.	At Feeding Point.			At Collectors of Car.				Remarks.
								Amp.	Volts.	K. W.	Amp.	Volts.	K. W.	H.P.	
Car A.															
5	2	89.5	4,430	0.30	0.08	88.6	20.6	51.2	5,662	—	50.0	5,376	358	487	Car alone.
2	4	89.5	3,950	0.84	0.12	97.5	20.8	—	5,165	—	74.2	4,835	446	606	Car alone.
6	2	89.5	7,930	0.54	0.07	106.0	24.0	51.1	6,383	—	50.1	6,024	407	553	Car alone.
2	4	89.5	4,550	0.57	0.11	102.5	25.0	—	6,740	—	76.0	6,360	535	727	Car alone.
3	4	188.4	8,700	0.61	0.07	113.3	25.0	101.0	6,253	880	—	—	813	1,105	Car drawing three passenger cars.
Car S.															
9	2	77.9	2,744	1.11	0.13	91.2	20.8	52.6	5,472	—	51.8	5,257	394	535	Car alone.
9	2	77.9	4,294	0.68	0.12	105.6	24.0	51.1	6,290	—	50.5	5,950	434	590	Car alone.
6	4	159.6	5,583	0.60	0.11	116.7	25.0	108.2	6,237	1,010	105.6	5,938	928	1,261	Car and two passenger cars.
1	4	193.4	8,300	—	0.07	115.0	25.0	110.0	6,140	988	107.0	5,450	855	1,160	Car and three passenger cars.

Observations taken in Autumn, 1902.

TABLE III.—AVERAGE VALUE OF THE ELECTRICAL AND MECHANICAL MEASUREMENTS TAKEN DURING PERIODS OF RUNNING AT CONSTANT SPEED.

No. of Runs.	No. of Motors Working.	Total Weight of Train in Tons.	Average Speed km/hour.	No. of periods per second.	At Feeding Point.			At Collectors of Car.				Efficiency of Electrical Output, P. C.	Power exerted on wheels.		Remarks.
					Amp.	Volts.	K. W.	Amp.	Volts.	K. W.	H. P.		H. P.	Pull in Kg.	
Car A.															
4	2	89.5	95	20.6	43.4	5,835	—	42.1	5,543	246	335	82.7	277	788	Car alone.
2	4	89.5	96	20.8	—	5,450	—	64.0	5,190	247	336	69.7	234	660	Car alone.
5	2	89.5	107	24.0	45.6	6,460	—	43.8	6,089	302	410	86.4	354	892	Car alone.
2	4	89.5	113	25.0	—	6,830	—	71.5	6,390	365	496	79.1	392	938	Car alone.
2	4	188.4	117	25.0	84.7	6,647	694	—	—	644	875	87.1	762	1,760	Car and three passenger cars.
Car S.															
8	2	77.9	92	20.8	36.7	5,781	—	34.5	5,619	197	268	84.0	225	660	
8	2	77.9	106	24.0	39.2	6,447	—	36.8	6,162	283	385	86.5	333	850	
4	4	159.6	117	25.0	69.2	6,937	566	65.0	6,685	499	679	85.5	580	1,330	
1	4	193.4	118	25.0	81.5	6,700	713	75.0	6,425	680	925	87.7	810	1,840	

Observations taken in Autumn, 1902.

TABLE IV.—RUNS. AT CONSTANT SPEED, OF THREE-PHASE LOCOMOTIVE WITH ONE TRAILER.

Date—June, 1902.	Run No.	No. of Periods per second.	Weight of Train in Tons.	Time of Measurements in seconds.	Speed in km. per hour.	Average at Feeding-Point.			Average Value of cos ϕ Calculated.	Average Power at Feeding Point.	Weight of Trailer in Kg.
						Amp.	Volts.	K. W.			
23	I.	30	52.25	810	70	10	7,250	76	0.60	At 70 Km/hour 91 K. W. = 124 H. P.	12,250
	II.	30	52.25	240	70	11	7,200	105	0.75		
24	I.	30	57.68	390	65-70	9.5	7,200	71	0.59		17,680
	II.	30	57.68	350	65-70	15	7,150	137	0.74		
25	I.	40	52.25	790	86	12	8,200	136	0.79	At 86 Km/hour 184 K. W. = 250 H. P.	12,250
	II.	40	52.25	800	86	18	8,100	222	0.86		
	III.	40	52.25	760	86-88	13	8,250	150	0.81		
	IV.	40	52.25	820	86	18.6	8,150	226	0.86		
26	I.	47	70.75	410	101-102	20.5	10,650	322	0.84	At 102 Km/hour 293 K. W. = 398 H. P.	30750
	II.	47	70.75	390	102	18.5	10,850	286	0.285		
	III.	47	70.75	340	101.5-102	18	10,770	270	0.81		
	IV.	47	70.75	360	101.5-103	19	10,770	290	0.82		

The German Railroad Union announces the prizes awarded as offered in 1902, for improvements in appliances, and valuable treatises on subjects relating to railroads. Three prizes of 3,000 marks ($714) each are awarded as follows: To Prof. Barkhausen, of Hanover, privy government councillor, for an improved water tank for water stations; to Prof. Von Borries, of Berlin, likewise a privy government councillor, for steam valves for compound locomotives to secure increased supply to the low-pressure cylinder; to Dr. Uebelacker, of Eger, railroad assessor on the Bavarian State Railroads, for a treatise on the movement on curves of locomotives with trucks. Prizes of 1,500 marks each are awarded to Railroad Inspector Leyffert, of Halle, for an apparatus for moving switches; to Dr. Wiedenfeld, a university instructor in Posen, for his treatise on the economic importance of the Siberian Railroad (a summary of which was published in the *Railroad Gazette*); to Baron Rinaldini, of Vienna, for a commentary on the regulations for railroad operation of the countries represented in the Council of the Empire, and to Dr. Hilscher, of Vienna, for a work on the Austrian-Hungarian and international transportation law. Four of these seven prizes are for books, while two of the others, for inventions, to Professors Barkhausen and von Borries, are to men who are authors of important engineering works.

Four Officers of the International Railway Congress.

The coming of the International Railway Congress to this country for its seventh session, which is to be held at Washington next May, will doubtless bring to our shores many European railroad men with whose faces we are not familiar; and by way of introducing to our readers two of these gentlemen we give herewith the portraits of the President and the Secretary of the Permanent International Commission, Messrs. Dubois and Weissenbruch. Along with these we show the portraits of the President and the Secretary of the American section of the Congress.

Mr. Arthur Dubois, President of the Permanent International Commission of Railroads (The International Railway Congress), is 66 years old, and has all his life, until a year ago, been connected with the state railroads of Belgium. He was made an Honorary Engineer of bridges and roads in 1859, and for a time was an instructor in the School of Civil Engineering connected with the University of Ghent. His first railroad service was as Engineer in the bridge and roadway department, and his first official position in the administration

Arthur Dubois.

of the state railroads was as Chief Engineer in the roadway department. He was for a time Director of Works and then was a member of the Committee of Direction for 20 years. He was put on the retired list on the first of last October. For ten years (1869-79) he taught the course of railroading at the University of Ghent.

Mr. Dubois is President of the Council of Administration of the Prince Henry Railroad of Luxemburg, and is interested in other commercial enterprises, including the International Sleeping Car Company, in which he is a member of the Finance Committee. He has been a member of the International Railway Congress since its organization, and President since 1893.

Mr. Louis Weissenbruch, Secretary General of the Permanent International Commission of Railroads (The International Railway Congress) is 47 years old, and was born at Liege, Belgium. He was graduated from Brussels University and from the military school of Brussels and was Brevetted Sub-Lieutenant of Engineering in 1879. He served three years with the artificers of engineering at Antwerp, and in July, 1882, was appointed to a position with the ministry of railroads at Brussels. In a short time he was appointed Railroad Engineer and Private Secretary to the Minister, and thence was successively promoted to be Engineer, Chief Engineer in the traction department; specialist in the department of commercial administration, chief of section in the railroad department, and (1901) Director of the safety appliances department. Mr. Weissenbruch has been with the International Railway Congress from its origin, having begun as Private Secretary. He has been "Reporter" on various technical subjects,

Louis Weissenbruch.

having presented papers to the Congresses of 1885, 1887, 1889 and 1892. He is also the author of numerous technical articles in the Bulletin of the Congress and in other publications. He was one of the editors of the French edition of the History of Russian Railroads down to 1892, which was published by the Russian Government.

Mr. Stuyvesant Fish, President of the American section, is the President of the Illinois Central Railroad and of the American Railway Association, having been elected to the latter position last April. Mr. Fish's career is already well known to our

Stuyvesant Fish.

readers, and at the time of his election a sketch of his life was published in the *Railroad Gazette* (April 29, page 328).

Mr. William F. Allen, Secretary of the American section, probably stands as little in need of an introduction to our readers as any railroad man who could be named, his long service as Secretary of the American Railway Association having made his face familiar to operating officers throughout the country. Mr. Allen was born at Bordentown, N. J., Oct. 9, 1846, the son of Col. Joseph Allen, C. E., who lost his life in the Civil War. Mr. Allen was Assistant Engineer on the Camden & Amboy at the age of 14, and in 1868, at the age of 22, was appointed Resident Engineer of the West Jersey Railroad. He was made Editor of the *Official Railway Guide* in 1873, and later became Manager of the company which publishes it, the National Railway Publication Company. He has been Secretary of the American Railway Association from its birth in 1886, having been Secretary of its constituent organizations, the General and Southern Time conventions for a dozen years before that. The distinction which has made Mr. Allen best known to the world is that of having prepared the plan which finally resulted, in November, 1883, in the adoption of our present standards of time, based on even-hour divisions from the meridian of Greenwich. This quiet but far-reaching reform did away with a diversity of time standards which can hardly be appreciated by those whose experience dates from 1883 or later. Standards conforming in this way to Greenwich time have since been adopted by other nations in all parts of the world, and he has been a prominent figure in all public discussions in this branch of science.

William F. Allen.

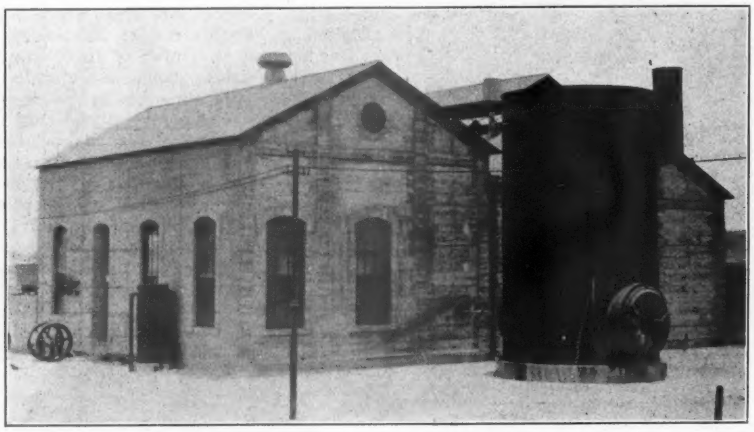
Mr. Allen is best known to the younger generation of railroad men by reason of the intimate relations that they have with him in connection with his activities in the American Railway Association. He takes an active part in the work of the Committees, and no other officer of the Association has served so many years as he. The American Railway Association has been connected with the International Railway Congress since 1895, and Mr. Allen was a delegate to the London and the Paris meetings. He is a member of the American Society of Civil Engineers and of numerous other scientific societies.

June 23 was the 100th anniversary of the birth of August Borsig, who may be called the Matthew Baldwin of Germany. Beginning as a carpenter, he as a man learned drawing and mechanics in a trade school; became foreman of a foundry; started one himself; developed it into a machine shop; turned out his first locomotive in 1841 and his 500th in 1854, and died a few months later; his son Albert completed the 1,000th engine in the works founded by his father in 1858, and his grandsons, Ernst and Conrad, the 5,000th in 1902. Some of the most accomplished engineers of his time have testified to the extraordinary capacity of August Borsig.

The Mexican Central Shops at Aguascalientes.—II.

BY C. T. BAYLESS.

The Power House.—The theoretical center of distribution from the standpoint of electrical power consumption was taken for the location of the generating plant, which has ample power capacity both for motors and the future lighting system. The current is carried by overhead conductors to the different shop buildings. Steam is delivered to the smith and hammer shop and the rolling mill through a pipe line in underground conduits, and compressed air is delivered to all the shops through an underground pipe system with reservoirs above ground at such intervals as to afford little chance of the local pressure being materially diminished by a sudden or unusual demand at any place on the line.



Power House.

The power house is built of concrete and rubble masonry. Unlike most of the other buildings, the walls are carried down to the ground. In this locality the ground never freezes, the average temperature being about 55 deg. F. throughout the year, and the rainfall is confined to a short season. The soil is of a peculiar formation. There is a surface stratum of loose structure which varies in thickness from 1 in. to 3 ft. Below this is "tepetate" to a great depth. This tepetate is extremely solid, and in digging an ordinary pick makes almost no impression. A bar and heavy sledge is the regular equipment, and blasting is often resorted to. The three factors which rendered solid walls necessary for the power house are the sand storms which prevail from January till June, the rains from June till October, and stealing. This last is fully as important as either of the former.

A skeleton structure of solid concrete piers supports the roof trusses and forms the framework of the building. Where solid walls were desired they were made by filling in between these piers with lime concrete. The north wall is temporary to allow for future extension, and is built of adobe, faced with cement in imitation of cut stone, and reinforced by brick piers. In the boiler room, the entire east side is open between the piers clear to the roof, except in one bay which has since been closed in with corrugated galvanized iron, to protect the belting of the mechanical draft apparatus from rain.

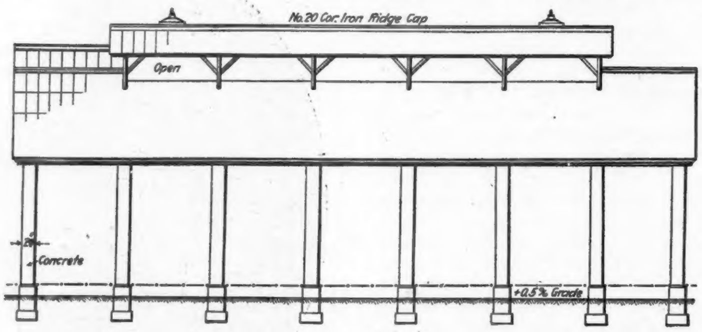
The foundations for the outside engine room walls and the north and south boiler room walls extend 2 ft. below the grade line and rest on hard tepetate. The concrete piers, composed of one part Alsen Portland cement and eight parts fine broken stone, are 26 in. square and are set on a base 32 in. square and 24 in. deep. These piers rise to the roof, the lower chord of the engine room trusses being 29 ft. 3 in. and of the boiler room 22 ft. 6 in. above the ground. The piers between the boiler and engine rooms are heavier and their foundations are deeper, as they support the roof trusses of both rooms and reinforce the steel columns which carry the engine room crane.

Between the concrete piers the walls of lime concrete are carried to the same depth as the piers, and after the forms were removed the entire surface, inside and out, was finished with a cement wash. All the walls are 16 in. thick, except the temporary adobe wall, which is 20 in. thick. Between the piers on the open side of the boiler room a 16 in. rubble wall is carried up to within 6 in. of the floor level, and a coping of cement concrete finishes it even with the floor.

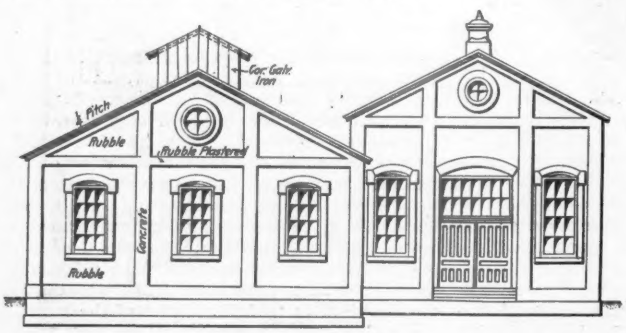
The surface drainage is excellent, and as water is not found in the region of the shop yard at less than 175 ft. deep, no special preparation for a floor to protect it from moisture from below is necessary. The loose surface loam was cleared off to the tepetate, and more tepetate filled in and tamped wet to within 12 in. of floor level. Above this is concrete, in the proportion of one part Alsen Portland cement, three parts clean, sharp sand, and six parts of broken stone. A cement finish 1 in. thick, of one part cement and one part sand completed the floor. This floor is used throughout the power house, except in front of the boilers. Here tepetate was filled in and tamped wet to within 6 in. of floor level. The same mixture of concrete extends $5\frac{1}{2}$ in. Twelve hours was allowed for partial drying and then $\frac{1}{2}$ in. cast-iron plates 36 in. square were laid and set with a slight filling of neat cement.

The condenser pit is 35 ft. x 15 ft. x 15 ft. deep, and is in the northeast corner of the engine room, and in the boiler room is a pit of the same depth, for the main boiler feed pump and the centrifugal pump of the boiler test apparatus. A door in the partition wall between engine and boiler rooms connects the two pits. The floors are of concrete 6 in. thick on the tepetate in its natural state. In one corner of the condenser pit is the hot well, a cement-lined pit 10 ft. x 5 ft. x 5 ft. deep. Another small pit in the center of the condenser pit, directly under the condenser, is for a small pump, belonging to the condensing plant.

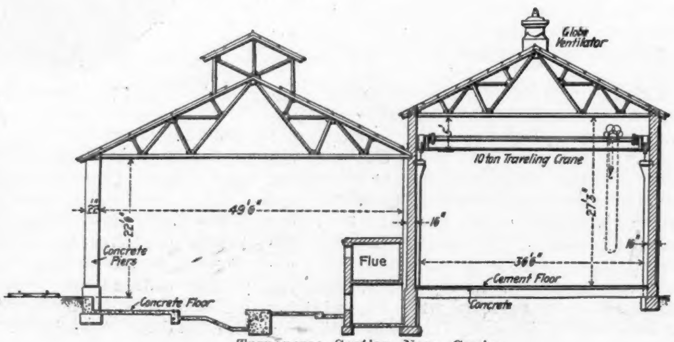
Except in the power house and the coach paint shop there are no structural steel roofs. In these two buildings the higher fire risk made it advisable to use incombustible material. The trusses are of light tri-



Rear Elevation.

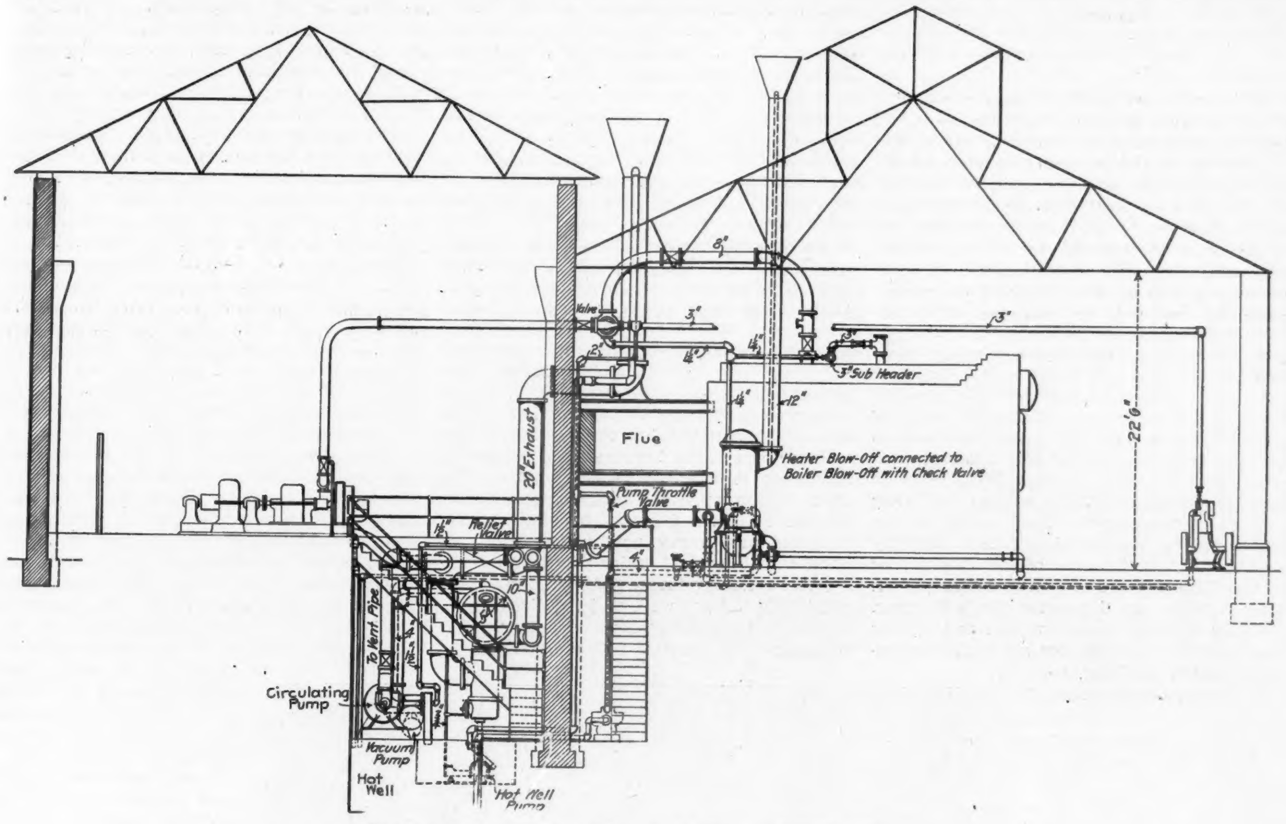


End Elevation.

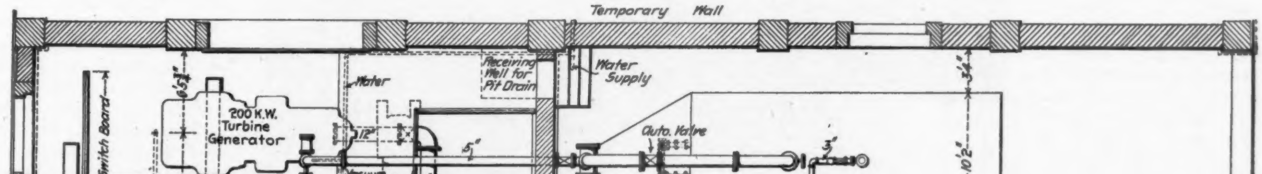


Transverse Section Near Center.

Power House—Aguascalientes Shops, Mexican Central Railroad.



Section and Part Elevation of Engine and Boiler Room.



Plan of Engine and Boiler Room.

angular form, one-quarter pitch, built up of steel angles. The purlins are Z bars. Corrugated galvanized iron, fastened to the purlins with special galvanized clips, completes the roof.

The boilers are hand fired and the coal and ashes are handled manually. The coal and ash handlers in the boiler room are paid 50 cents Mexican currency (22 cents U. S.) per day; firemen, 75 cents Mexican (34 cents U. S.); and head firemen, $1 Mexican (44 cents U. S.). Coal is unloaded from the cars at $1.50 per car and ashes loaded at the same cost. At the present shop load of about 175 k.w., all the coal used is handled from the car, through the bin, boiler, ash pits, and back to the ash car for $2.50 Mexican ($1.14 U. S.) per day, which is equal to $0.00143 Mexican ($0.00065 U. S.) per kilowatt hour. Thus, it is exceedingly doubtful if there would be any economy in installing coal-conveying machinery and mechanical stokers, or even elevated coal bunkers. Accordingly, a coal bin was built on the ground abutting the north wall of the boiler room and fronting the track east of the building. An arched door leads directly from the bin to the front of the boilers. The walls of the bin are of heavy masonry 8 ft. high, and the capacity of the bin is 200 tons.

Water is never over-plentiful, and during the latter part of the dry season is exceedingly scarce at times, so that every possible means and mechanical device has been utilized for reclaiming every available pound of water. The steam plant consists of three 250-h.p. Babcock & Wilcox wrought-steel sectional water-tube boilers, set in one and one-half batteries. Each boiler is equipped with a Babcock & Wilcox superheater with 264 sq. ft. heating surface, which superheats the steam 100 to 120 deg. Fahr. The water columns, also Babcock & Wilcox, are fitted with automatic closing valves and safety gage-glass valves which may be closed from the floor. The total heating surface of each boiler is 2,690 sq. ft. and the grate area 52 sq. ft., giving 51.7 sq. ft. of heating surface and 5.08 sq. ft. of superheating surface per square foot of grate area. The two south boilers are equipped with thermometers, thermometer wells, draft gages, pyrometers, etc., for coal tests. A test is run nearly every working day on one boiler. In the north boiler, the shavings from the planing mill are burned.

The flue, which is of sufficient capacity for 1,500 boiler horse-power, takes the gases of all the boilers. The present flue will be a by-pass to a future economizer, so that access may be had to the economizer without interfering with the operation of the plant. Space has been left for the economizer, and outlets have been left in the feed piping for the connections. At present the by-pass connection constitutes the only flue and leads directly through the fans of the induced draft apparatus to the stack, which is 5 ft. in diameter and 27 ft. long from the top of the fan housing.

The induced draft equipment, which is Sturtevant, consists of two steel-plate fans arranged in a vertical tandem manner, the lower fan is three-quarters housed and the upper one full housed. The wheels are of the overhung type on 4 in. shafts, and each fan is capable of maintaining a draft pressure in the flue connection of each boiler equal to ¾ in. of water, when handling all the gases of combustion from the burning of 3,500 lbs. of coal per hour, with a flue temperature of 600 deg. Fahr., and running at a peripheral speed of fan wheel not exceeding 7,000 linear feet per minute. The ring-oiled fan bearings are water jacketed, except the outboard bearings, which are not subjected to external heat. A counterbalanced sliding damper enables either fan to be cut off from the flues, or both at the same time. Each fan is operated by a Sturtevant vertical simple engine belted to the fan. These engines will operate on 20 lbs. of steam, and as the natural draft is always sufficient to develop this pressure, the draft can always be started and maintained independent of the electrical apparatus, or the compressors run and steam supplied for outside purposes without running the dynamos.

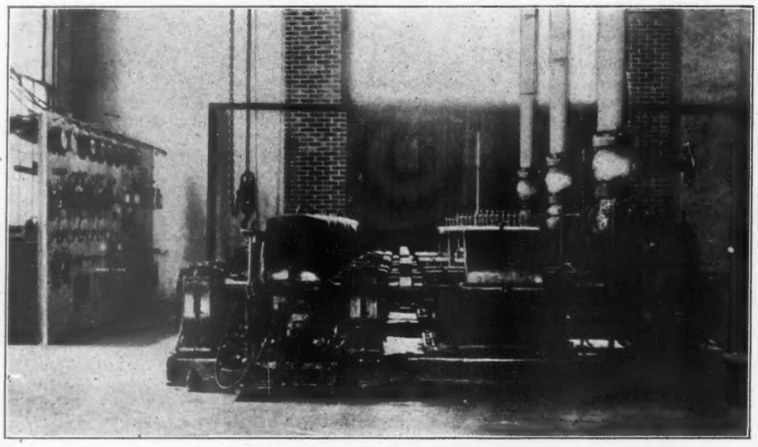
There are three independent systems of supplying feed water to the boilers. The main feed pump is a Knowles simple duplex 7½ in. x 5 in. x 6 in., with outside-packed plungers and heavy pot valves, and can handle 2,500 gals. of water per hour against 200 lbs. boiler pressure. The suction is supplied from the hot well, and the discharge is passed through the feed water heater before entering the boilers. The heater is a Wheeler closed type with straight brass tubes and removable heads; the capacity is 750 h.p. with 250 sq. ft. of heating surface. A by-pass in the feed piping permits the heater being cut out of service if necessary. With the limited amount of exhaust steam from pumps and air compressors available this heater gives an average temperature within forty degrees of the boiling point.

The second system of feed-water supply is the boiler test system. The piping is independent of the main system and the valves controlling the water of the two systems are located on the front of the boilers. A small motor-driven centrifugal pump takes water from the hot well and delivers it to two measuring tanks of approximately 132 gals. capacity. From these two tanks the water gravitates to a third tank, with a capacity equal to four of the measuring tanks. A 6 in. x 3½ in. x 6 in. Knowles pump, of the same type as the main feed pump, passes this measured water through a smaller Wheeler feed-water heater into the boilers. In emergencies the measuring tanks may also be supplied directly from the water mains. The steam supply for the test feed pump is taken from a reduced-pressure header leading to the fan engines. This header may be fed by either the main steam header or the 3 in. saturated steam header, and it is a continuation of the header which supplies the air compressors.

A third system of feed is by means of a No. 8 Friedman injector, which takes steam from the saturated steam header at full boiler pressure and takes water directly from the mains.

The generating equipment consists of three 300-h.p. De Laval steam turbines fitted with De Laval centrifugal governors, and each direct-connected by gearing to two 100-k.w. Milwaukee multi-polar direct-current dynamos, the whole forming a 200-k.w. unit. Under the guarantee, the turbines operate with 200 lbs. steam pressure at the governor valve, equivalent to 27 in. of vacuum at this altitude (6,200 ft.), 100 deg. Fahr. of superheat, and at 10,500 r.p.m. with a speed regulation of 2 per cent. from no load to full load. Two spiral-tooth pinions made solid with the flexible turbine shaft, with their teeth set in two rows at an angle of 90 deg. to each other, mesh with gears mounted on the two main shafts, which are connected to the dynamo shafts by flexible couplings and reduce the armature speed to 900 r.p.m. The overload guarantee is 25 per cent.

The steam consumption guarantees per brake horse-power were: Full load, 14.6 lbs.; three-fourths load, 15.1 lbs.; one-half load, 16.1 lbs.; one-fourth load, 19.0 lbs. With such economy on the lower range of loads it was not considered necessary to install a smaller unit to care for the night or lighting loads.



Engine Room (Generator Units and Switchboard).

No cylinder oil is used and there is no oil in the exhaust steam, which makes it possible to use a surface condenser. An Alberger condensing plant was installed capable of condensing 20,000 lbs. of steam per hour under the existing atmospheric conditions, with the exception of the cooling tower, which is of sufficient size to cool the condensing water when condensing 40,000 lbs. of steam per hour.

The circulating water is handled by a centrifugal pump with 10 in. supply and discharge pipes, built by the Kingsford Foundry & Machine Company, Oswego, N. Y., and connected by a flexible shaft coupling to a 30-h.p. Crocker-Wheeler shunt-wound motor. Thermometers located in the 10 in. discharge and suction pipes show at a glance whether the circulating water is being properly cooled. The Alberger cooling tower is located just south of the power house. It is 32 ft. high and 19 ft. in diameter, and the walls of a concrete reservoir 5 ft. deep form its foundation. Two 8-ft. fans at the bottom drive a current of air up through the 4-in. square spaces between crossed courses of ¾ in. cypress boards set on edge, which constitute the cooling surface. The 10 in. discharge pipe from the condenser ends in a sprinkler head about 5 ft. below the top of the tower, the force of the water operating this head, which revolves slowly and gives an even distribution of the discharged water over the entire area of the tower. The shaft on which the fans are mounted extends through a wall bearing into the engine room, and is belted to a 30-h.p. Crocker-Wheeler shunt motor mounted on a bracket on the wall above. Both this motor and the one driving the circulating pump have their panel boards on the walls of the engine room, so that they can be started up again

quickly in case the main circuit-breakers are thrown out. The condenser with its auxiliaries make an exceedingly compact group, as the 900 h.p. occupies a floor space 15 ft. x 25 ft., excluding the cooling tower.

The main air compressor is a Laidlow-Dunn-Gordon duplex, two-stage, horizontal, cross-compound, direct-connected, fly-wheel type with separate intercooler and receiver. The steam cylinders are 15 in. and 24 in. x 18 in., and the air cylinders 14 in. and 14 in. x 18 in. With 125 lbs. steam pressure and 120 r.p.m. it has a capacity for compressing to 100 lbs. per sq. in. at an altitude of 6,500 ft., a weight of air equivalent to 800 cu. ft. of free air per minute at sea level. As an auxiliary to the main compressor is a straight-line Class A Ingersoll-Sergeant No. 7 machine. It is a single-stage type with steam cylinder 14 in. x 18 in. and air cylinder 14¼ in. x 18 in., and when running 120 r.p.m. has a capacity for compressing to a pressure of 100 lbs. per sq. in., a weight of air equivalent to 382 cu. ft. of free air per minute at sea level.

All pipes for high-pressure steam is extra-heavy wrought iron of National Tube standard, while the piping for exhaust steam, water, air, oil and drips, unless otherwise specified, is of full-weight black iron pipe of National Tube standard. All water and air pipes which are run underground are cast iron, nowhere less than ½ in. thick, with bell and spigot connections and joints calked with lead.

All fittings for live steam, pressure feed water and the high-pressure drip piping are extra-heavy cast iron, flanged or screwed, as best suited to each case. Fittings for exhaust steam, water and air pipes are of standard weight cast iron, flanged or screwed as required, except where located in the ground. All flanged or screwed fittings and valves are the Eaton, Cole & Burnham Company make. The valves used in live steam, pressure feed and pressure drip return lines are of extra-heavy pattern, with cast-iron bodies and hard bronze seats. Sizes 8 in. and above are fitted with a by-pass and valve. Valves on other lines are of standard weight pattern with cast-iron bodies and hard bronze seats.

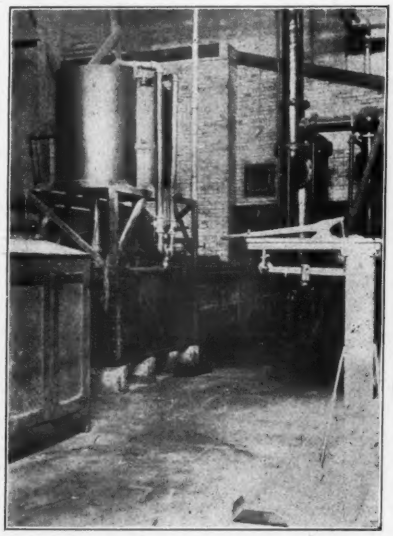
Gaskets for live steam and pressure feed flanges are of corrugated copper, in no case less than 24 gage, thoroughly annealed and of proper diameter to come within the bolt circle. Gaskets for exhaust steam, water and air pipe flanges are of "Rainbow" sheet packing, 1/16 in. thick. The underground compressed air piping, which was rated for 100 lbs. air pressure, was tested and made thoroughly tight under 150 lbs. hydraulic pressure.

A full set of gages are mounted on a marble panel in the engine room. The instruments have 8½ in. dials and are mounted in heavy brass cases. Two high-grade Tagliabue angle thermometers are installed in the boiler feed line, and one in each boiler feed pipe just below the check valve. These thermometers are mounted on the two test boilers and give the temperature of the entering water either from the main feed line or the test feed line. A third thermometer is located near the discharge from the test feed pump, so that the actual work done by the feed water heater may be noted at a glance.

All live steam piping is lagged with "fire felt" material made by the H. W. Johns Manufacturing Company. All such piping 6 in. and above has a first covering of fire felt sheets 1 in. thick, closely wired to pipes, and is finished with a coat of asbestos cement ½ in. thick, troweled hard. Pipes less than 6 in. have a sectional covering of fire felt 1 in. thick fitted closely and held with brass bands, all joints being left tight. After all the covering was finished, it was given a coat of glue sizing and two coats of first-class lead and oil paint.

The dynamos are the double armature type built by the Milwaukee Electric Company for direct connection to De Laval steam turbines. A flexible bolted coupling connects the armature shafts to the driving shafts. Each side of the double machine is a compound-wound, four-pole, direct-current 100-k.w. generator, over-compounded 10 per cent., with a working range of e.m.f. from 250 volts at no load to 275 volts at full load. This rather high over-compounding was specified on account of several comparatively long lines to points where there is a considerable cousumption of power. The current output of each generator set is 800 amperes at 250 volts, or 400 amperes at 500 volts, making the maximum output of the station at 25 per cent. overload, 1,500 amperes at 500 volts.

Traversing the entire engine room is a 10-ton crane built by Maris Brothers,, Philadelphia. The span is 36 ft. 5 in. between centers of runway rails and the lift is 22 ft. 3 in. The load is carried on two strands of chain and is held at all points, both in hoisting and lowering, by an automatic friction brake. Hoisting is at two speeds, one double the other, the change being effected by a shackle on the lower block. All the movements are by hand, and the gearing is such that one man can handle the full load at 60 ft. a minute on the trolley, 40 ft. a minute on the bridge, and three men can lift full load 1 ft. a minute, or one-half load 2 ft. a minute.



Feed-Water Heater and Measuring Tanks for Coal Test.

Distribution.—In deciding on the system of electrical disribution and control as related to the driving of machine tools, all due consideration was given to the manifold advantages of multiple voltage with several available voltages. However, to obtain the best results which one has a right to expect from such a highly developed and relatively complex system, it is preferable, if not absolutely essential, that the machinists operating the tools be of as relatively high an order as the apparatus. In a shop where probably 75 per cent. of the men operating machines are necessarily common Mexican laborers—many of whom cannot write their own names and are about the mental equals of the uneducated negro—it is exceedingly doubtful if it would be advisable to install multiple voltage with all its refinement of controlling apparatus. Induction motors in their extreme simplicity seemed ideal and were considered. But their adaptability to crane and other variable speed work was a much mooted and still open question. After carefully balancing the advantages and disadvantages of all the available systems, together with their widely differing costs of installation and maintenance, it was finally decided to adopt the familiar Edison three-wire system with 250 and 500 volts direct current. De Laval turbine generators with their two armatures driven by one turbine shaft are admirably adapted for this work. On all individually-driven tools where variable speed was desired, compound starting and regulating rheostats were used in addition to the two voltages, and the motors were so connected to the tools as to preserve the variable speed features of the machines themselves. For instance, in the case of a 48 in. engine lathe, the motor is geared to the countershaft, whose five-step cone is belted to the lathe. With the two voltages and the five steps of resistance, which can be cut into the field circuit and the five-step cones, this machine has 50 different and easily-available speeds. The change from 250 to 500 volts, or vice versa, is made by means of an ingenious switch designed by Mr. Leslie Griscom and shown in Fig 6. The field resistance is controlled by the regular starting lever.

The smaller machines are driven in groups by constant speed motors. The distance from electrical supply houses rendered it advisable to have the fewest possible sizes of motors consistent, in order that the stock of repair parts be as small as possible.

The switchboard is 2 in. blue Vermont marble. There are six panels of a uniform height of 6 ft. 6 in., surmounting 12 in. marble pasteboard panels. There are three generator panels, 30 in. wide, a voltmeter panel 30 in. wide, and two feeder panels 36 in. wide. The generator panels each carry a 400-ampere double-pole laminated type I-T-E circuit breaker, a 500-amp. triple-pole, quick-break main knife switch, two 500-amp. Weston round-type switchboard ammeters, and two Wirt field rheostats. The voltmeter panel contains two 750-volt Weston round-type voltmeters, and two 12-point voltmeter switches for connecting the voltmeters to any circuit on the ground as desired. Thus no other ground detector is needed. On this panel is also mounted a 2,500-ampere Thompson recording wattmeter for recording the total station output. The next panel is a feeder panel and contains four 500-amp. triple-pole, quick-break switches, and the total load ammeter, a 3,500-amp. Weston round pattern. These four switches control all the shop power circuits and the separate circuit for the 60-ton cranes in the erecting shop. The last, also a feeder panel, was added later and contains two 500-amp. triple-pole, quick-break knife switches, one 75-amp. double-pole, carbon-break knife switch, and a 300-amp. Thompson recording wattmeter for recording the consumption of power by the timber preserving plant. The 75-amp. switch controls the circuit of the two 30-h.p. motors of the condensing plant; one of the 500-amp. switches is for the line to the timber preserving plant, and the other is for the future lighting feeders.

From the switchboard five lines of feeder cables distribute the electrical power. The lighting system, to be installed at some future time, will be controlled by separate feeders leading from the power bus bars. The only exception to this is the timber preserving plant, which has its lighting system,

fed from the power lines; 250-volt enclosed arc lamps and 250-volt incandescent lamps burning singly are to be used throughout. Running the lighting system from the power bus bars will not result in flickering lamps if the turbine regulation continues in its present perfection, for lights have been tried at various points of the system and no flicker was noticeable.

Following is a table covering the feeder system:

Feeder No.	Size.	From switchboard to	Total rated h.p. on line.	Approx. distance from switchboard to entrance board.
1	400,000 cm......	Machine shop	331	350 ft.
		Hammer and smith shop	135	200 "
2	No. 000 B. & S....	Brass foundry	15	300 "
		Rolling mill	20	470 "
3	500,000 cm......	Iron foundry	50	720 "
		Pattern shop	10	1,140 "
		Planing mill	175	1,350 "
		Paint shop	20	1,600 "
4	No. 2 B. &. S.....	Cranes in machine shop	302½	350 "
5	250,000 cm......	Truck, wheel and axle shop	35	1,350 "
		Timber pres. plant	125	3,200 "

Double-braided weatherproof wire is used for the aerial lines, and for open wiring in the buildings, slow-burning, double-braided weatherproof wire. All conduit wiring is done with double-braided rubber-covered wire, and where run in tile ducts, paper-insulated wire covered with lead is employed. All conduit work is installed on the single tube system with loricated iron conduit. Porcelain wall bushings are used at all entrance points, and the wiring is all in accordance with the rules and requirements of the National Board of Fire Underwriters of the United States. Overhead wires are carried on iron poles at a height of 20 to 25 ft. from the ground. Poles are spaced about 80 ft. apart and are set 5 ft. deep in a bed of cement 18 in. in diameter, which extends above the ground and tapers up from the circumference toward the center till a tight joint is made with the pole at a point about 8 in. above the ground. This was done to prevent the rusting away of the pole at the ground line. Iron brackets and No. 2 Knox glass cable insulators carry the heavy cables. All sizes above No. 2 B. & S. are of stranded wire. Wurts non-arching lightning arresters are used at all entrances to buildings, and a thorough ground was made at all points where needed either on the pipes of the water system or with heavy ground plates well buried in coke.

The wiring on entering the buildings is carried to a fused quick-break knife switch located at a convenient point, and from this switch the branch wiring radiates to the various motors. The machine shop is typical of all the buildings in this respect. The mains are carried to the entrance board and from there the three-wire branch mains are run open in a loop around the shop, being supported by the lower chord of the roof trusses of the side bays. Branches to the machines are carried in conduits down the columns of the building to the motor panel boards. Wires are then run in conduit to the motor.

Group motors are all run at constant speed on 500 volts. Individual motors are in some cases run on either 250 or 500 volts. All motors for machine tools are Crocker-Wheeler, open frame, shunt or compound wound as suited to each case. Starting boxes and compound starting and regulating boxes were made by the Cutler-Hammer Company, and the circuit breakers which are used on all motors above 15 h.p. are of the Cutter Company's I-T-E street car type. In all cases the motor-controlling apparatus is mounted on a slate panel board. The panel boards for the variable-speed motors carry an auxiliary interlocking switch, by means of which the voltage impressed on the armature may be changed from 250 to 500, or vice versa. A non-inductive resistance is cut into the motor circuit by opening the main switch so that the motor is protected during the change from one voltage to the other.

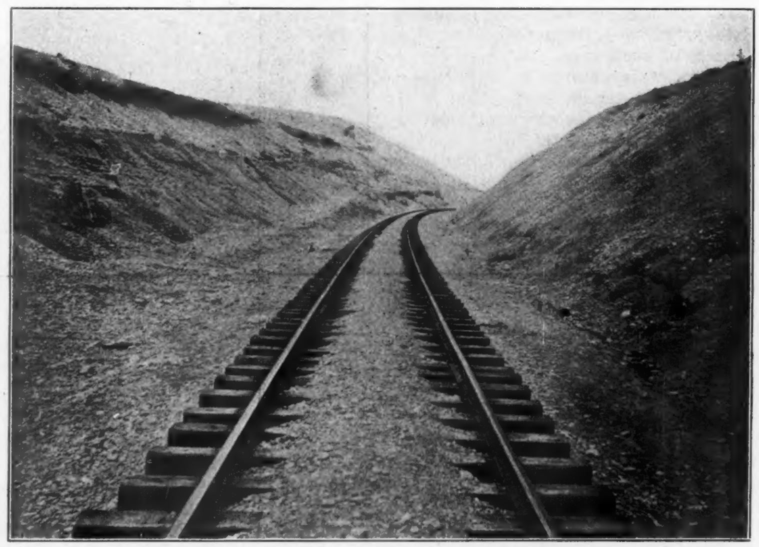
(To be continued.)

Permanent Way and Structures of the San Pedro, Los Angeles & Salt Lake.

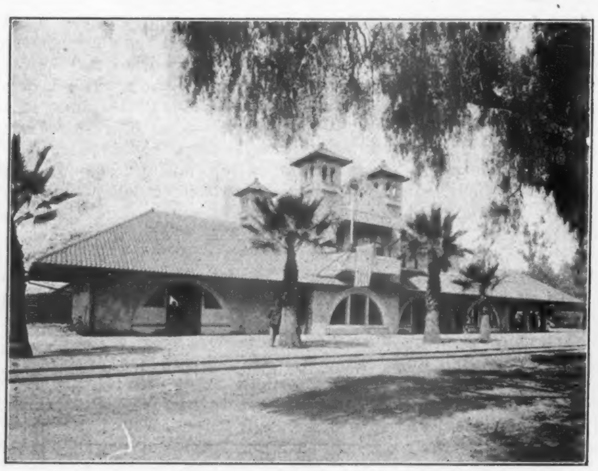
The San Pedro, Los Angeles & Salt Lake Railroad is expected to be ready for operation by January 1st, next. Only 100 miles remain to be laid with rails, 46 miles of which are yet to be graded. The contract for the grading has been awarded and the rails to close the gap are on hand, so that there is little doubt that the road will be finished on time. Considerable equipment has been ordered and should be in readiness for the opening of the completed line.

This road, which will be 777 miles long, joins Salt Lake and Los Angeles, and is of special interest because of its importance as a new transcontinental link. When first talked of, over five years ago, the project was ridiculed as being not at all practicable, and the obstacles confronting the projectors were many. Last year, however, the Oregon Short Line sold to the San Pedro & Salt Lake the trackage rights in Utah and Nevada, which were needed as a valuable part of the new road, and at the same time the company arranged for certain trackage rights in California with the Southern Pacific and the Santa Fe. With matters arranged with competitive lines on this friendly basis, the builders were in a position to proceed with their work.

It was decided at the outset to adopt high standards in building and equipping



Cut Through Stockton Dyke near Stockton, Utah.



Station at Riverside, California.

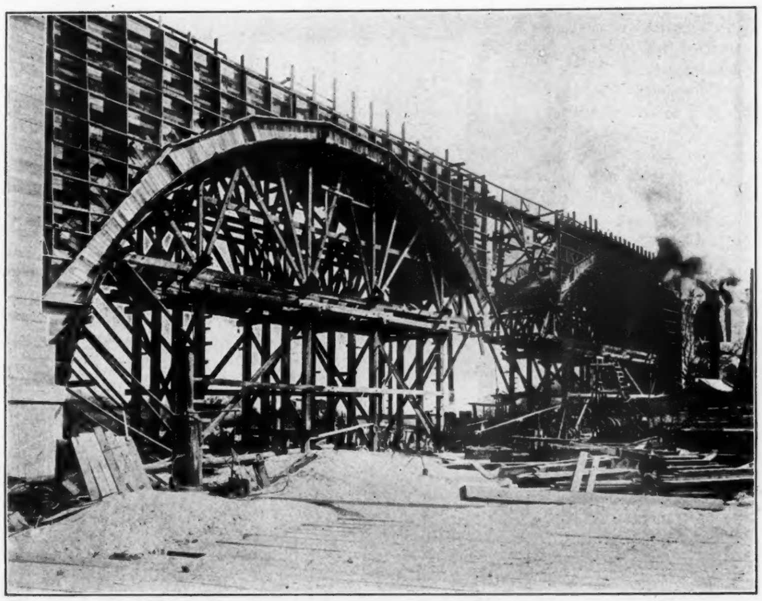
Typical Stretch of Track Through Southern California.

the line, making it first class in every respect possible, rather than to leave this to a subsequent period of rebuilding. The accompanying illustrations from photographs show how well this plan was carried out in the construction. The sub-grade is 18 ft. on fills and 20 ft. in cuts, being even wider in some places where it was necessary. The ties are standard sawed Oregon fir, laid throughout with heavy tie plates. The rails are 75-lb. A. S. C. E. section, and the wooden bridges have solid floors with continuous ballast.

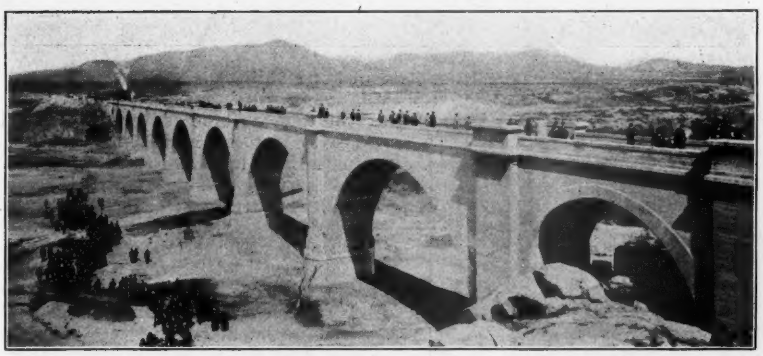
There is a great deal of concrete work along the line, the most notable example being the Santa Ana bridge across the Santa Ana River in California. This structure is probably the largest concrete bridge in the world. It contains 14,000 cu. yds. of Portland cement concrete, and consists of eight main arches of 86 ft. clear span and two approach arches of 40 ft. span. The height is 60 ft. above the ground. Many of the culverts and small building foundations are concrete. The standard water tank used along the line is steel on a solid concrete foundation. One of the illustrations shows the one at Rowland, Cal., which has a capacity of 72,000 gals.

On the new parts of the line there are a number of steel bridges on masonry abutments, the one shown being near Los Angeles. Later, all of the bridges on the old line in Utah are to be rebuilt and this part of the line will be brought up to standard. The artistic features of the stations in California will not, however, be duplicated in the desert sections. Wherever possible, flowers and lawns will surround the stations and all along the right-of-way the permanent structures, crossing signs, mile posts, etc., will be of a standard size and color. The stations in California are of the Mission style, and two typical ones at Riverside and Pomona are shown in the illustrations. A section of standard track in California is also shown, and this gives a good idea of the ballast and string stone work.

There is much attractive and interesting scenery along the route. Leaving Salt Lake City the line skirts the south shore of Great Salt Lake, passing through Stockton dyke, which once held back the waters of the lake, into the region of Stockton and Ophir and thence to Tintic, all great mining camps. At Lynn Junction the new line joins the old line acquired from the Oregon Short Line, which extended to Uvada, on the State line, where new track begins once more. The whole line through the State of Nevada is new construction. Most of the region traversed for 150 miles is a waste, although rich in mineral. After leaving Nevada the road reaches the line of the Santa Fe at Daggett and uses its track to Riverside. San Pedro, the western terminus of the line, is on the Pacific, and has good harbor facilities.



Santa Ana Viaduct During Construction.

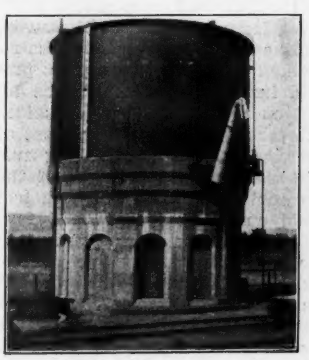


Santa Ana Viaduct.

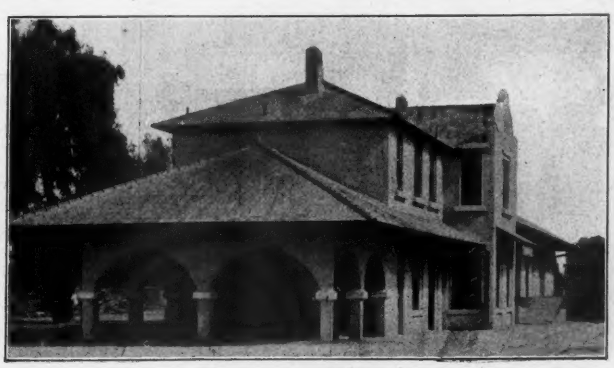
Foreign Railroad Notes.

Last Whitmonday a train took for the first time a party of excursionists, mostly Germans, from the Mediterranean at Haifa, past Carmel, over the Brook Kishon, by Megiddo and the foothills of the mountains of Galilee, between Mounts Hermon and Gilboa to the Valley of the Jordan, 800 ft. below sea level, where, under the basalt arches of the new bridge over the river, the excursionists, scorched by the burning sun on the platform cars, were (tell it not in Gath!) refreshed with copious draughts of Münich beer by the hospitable German engineer who is building the railroad.

During the Hungarian railroad strike the employees took possession of the railroad telegraph, and the management could send no messages except through the lines open to the public and belonging to the Post Office Department. To avoid the recurrence of such a condition, it is now proposed to turn over the railroad telegraphs to the Post Office Department permanently. As the railroad management needs to have and to use employees who have other duties, partly in telegraphing, this would seem an objectionable change. In a government with military habits and traditions one would suppose that the most obvious remedy would be to provide severe penalties, under the criminal law, for using the wires except in strict conformity to the regulations.



Standard Water Tank,



Station at Pomona, Cal.

Bridge near Los Angeles.

Disastrous Wreck at Eden, Colorado.

On the evening of August 7 at 8:45 o'clock, near Eden, Colorado, southbound passenger train No. 11, of the Denver & Rio Grande, broke through a trestle bridge which had been weakened by a flood, and the engine, baggage car and first two passenger cars fell into the water; and the cars were carried down stream by the powerful current that was flowing. Every person on this part of the train went down with the wreck, and all but three of them were killed. One of those who escaped was Fireman F. Mayfield. Two sleeping cars and a dining car (the rear part of the train) remained on the track. The total number who lost their lives was estimated on Tuesday at 100. Seventy-four bodies had been found (three unidentified) and 26 persons were missing. Of the dead and missing, 65 belonged in Pueblo, and four were employees.

Eden is 36 miles south of Colorado Springs, 111 miles south of Denver, and eight miles north of Pueblo. The scene of the wreck is the crossing of Dry creek, an arroyo which is usually dry and rarely flooded. The trestle bridge spanning it was about 100 ft. long and 15 ft. high. The flood is said to have been the result of a "water spout." Rain had been falling but a short time and no report had been received at the despatcher's office of damage to the track on this or any other part of the road; but the rain was heavy and the engineman was running slowly, probably about 15 or 20 miles an hour. The fireman was standing in the gangway between the engine and tender holding a torch as the engine entered on the bridge. The last words from the engineman were, "Put out that torch," shouted to the fireman as he felt the cab settle when the engine had nearly crossed the bridge. The fireman was thrown out of the engine as it fell over to the right, and managed to grasp a piece of wreckage from the bridge, on which he floated down stream to a curve in the bank, where he succeeded in crawling ashore. He started toward Eden to give the alarm and on the way met the station agent. The reports that the water was flowing over the track when the train ran upon the bridge appear to be erroneous; but the flood was a furious one, as is evident from the fact that the bodies of the cars floated half a mile or more down stream. The bodies of the persons who were drowned were found all along down stream for two or three miles, and some even further, one being taken out of the river at Pueblo, eight miles away. Many of the bodies were half buried in sand. The flood lasted but a short time and it seems likely that it was at its height just at the time that the passenger train reached the bridge.

The track was washed away for several hundred feet on each side of the bridge. Train No. 4, northbound, had passed over the bridge in safety about 45 minutes before the wreck. The train was in charge of Conductor J. H. Smith and Engineman Charles Hinman, both veteran employees of marked trustworthiness; and a traveling engineer was on the train, probably on the engine.

Railroad Shop Tools.

(Continued.)

BORING MILLS.

The 66-in. tire boring and turning mill, shown in Fig. 1 is made by the Niles-Bement-Pond Company, New York. This machine is designed especially for turning steel tires. It is simpler in construction than boring mills which are intended for general use. When fitted with a fixed cross rail this machine is very rigid, so that a heavier cut can be taken than with a boring mill of the same size designed for general service. This makes it an economical tool, when there is enough tire turning to keep the machine in constant use.

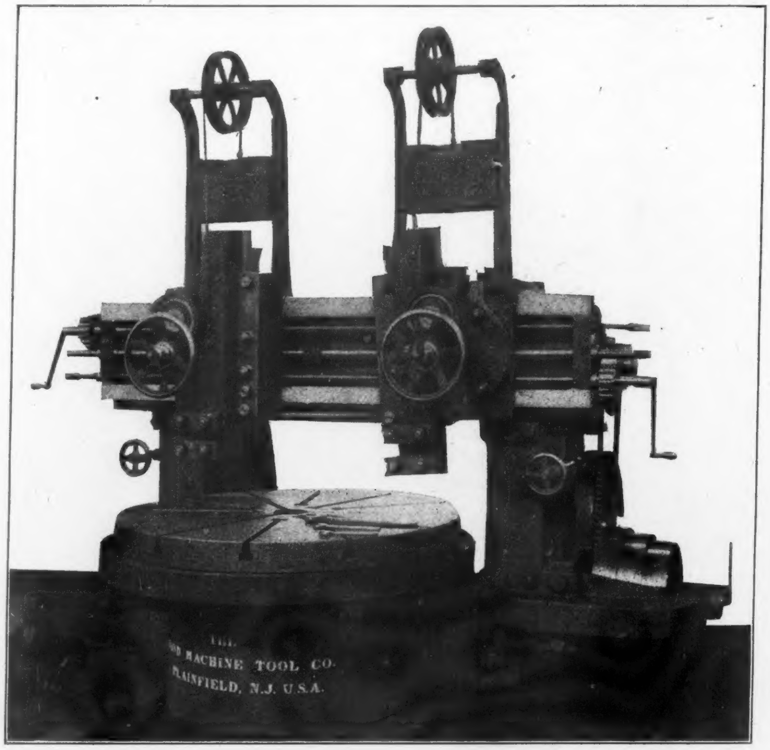


Fig. 1—The Niles-Bement-Pond 66-in. Tire Mill.

The machine when fitted with a fixed cross-rail will take work 68 in. in diameter, and 16 in. high. When fitted with an adjustable cross-rail the machine will take work 30 in. high. The face plate is 60 in. in diameter and has 12 changes of speed. It is driven by a cone which is geared to an external gear. The face plate has a wide bearing on the bed, and is mounted on a spindle having large bearings which can be adjusted to take up wear. The table has no opening through the top. A trough is provided around its edge for catching the lubricant used on the tools. The tool slides are counterbalanced and have a traverse of 16 in. They have large flat bearing surfaces which bear the entire length of the swivel. The tool slides are fitted with tool holders made up of two straps and four bolts. The cross-rail has a large flat wearing surface, deep arches, and a double walled back. When an adjustable cross-rail is used it is elevated by power. The saddles are fitted with taper packings and are moved by steel screws. The feed of each tool is independent of the other both in

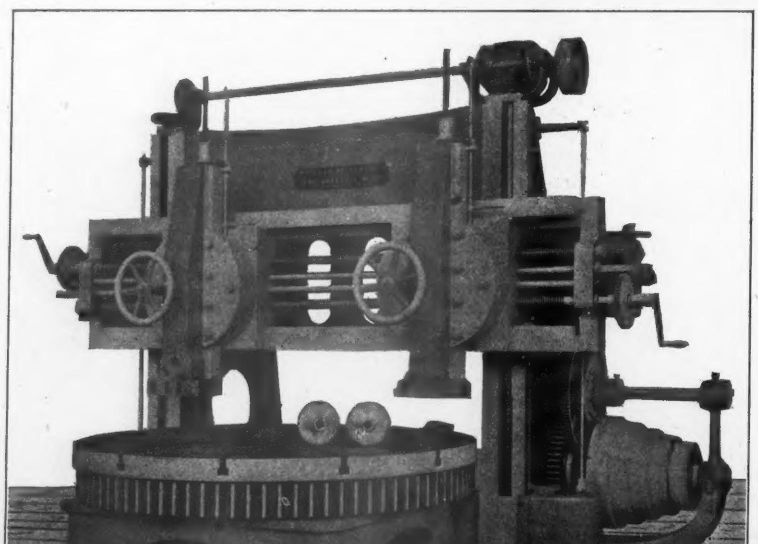


Fig. 2—The Sellers 84-in. Turning Mill.

amount and direction. The feed is operated by a disc driven friction wheel and can be instantly changed from O in. to the maximum feed.

The 84-in. boring and turning mill shown in Fig. 2 is made by William Sellers & Company, Philadelphia, Pa., and was especially designed for turning locomotive tires. The table is 84 in. in diameter and the maximum clearance under the cross rail is 39 in. The depth of the cross-head bar is $30\frac{3}{8}$ in. The vertical slides have a $26\frac{1}{2}$ in. adjustment and are furnished with detachable tool holders. The cross-head is raised and lowered by power. The saddles have independent feed and can be operated from both ends of the cross-head. The feed mechanism and the driving-gear are provided with safety devices to prevent breakage by overloading the gearing. The cone pulley has five steps, and there are two changes of gearing, with which 15 changes of speed can be obtained. The spur gearing for the table is all cut from the solid. The pulleys on the countershaft are 22 in. in diameter with a 5-in. face, and they should run at 280 r.p.m.

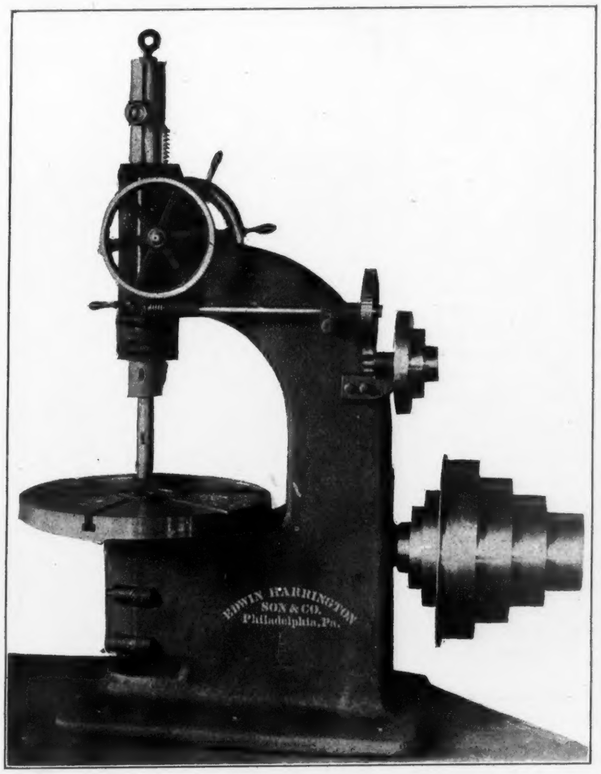


Fig. 3—The Harrington Vertical Boring Mill.

The vertical boring mill, Fig. 3, is made by the Edwin Harrington, Son & Company, Philadelphia, Pa. The mill is made in two sizes, 29 in. and 60 in., and is adapted for boring car wheels, pulleys, and general work. The spindles are crucible steel. They are power fed and are equipped with automatic stop and quick returns. They are also counterbalanced by a weight and chain. The table is driven by a cut bevel gear and pinion, the gear being bolted to the table. The table has six T slots for holding the work. There is an opening at the bottom of the mill for the escape of chips. The steps of the driving cone have a $4\frac{1}{2}$-in. face. The countershaft has two 22 in. x $4\frac{1}{2}$-in. pulleys and should run at 90 r.p.m. The weight of the 39-in. mill is 4,000 lbs. and the weight of the 60-in. mill is 5,000 lbs.

The 72-in. boring mill shown in Fig. 4 is made by the Colburn Machine Tool Company, Franklin, Pa. This mill is known as the widened pattern, as it is made from the 60-in. pattern, excepting the bed, which is widened sufficiently to give the required swing between housings. This machine will swing full 74 in. and is $45\frac{1}{2}$ in. wider under cross rail. The table is 58 in. in diameter and is geared 21 to 1 and 105 to 1, with back gears in. There are 20 changes of speed. The spindle is cast iron, having large angular babbitted bearings at the top and straight vertical bearings in the center. All of the bearings which run at a high speed are bushed with bronze. The heads are independent of one another in their movements, and can be set any angle up to 45 degrees. The tool bars carried in the heads have a movement of 25 in. A center stop determines the correct position of the heads when used for boring. The cross-rail is 9 ft. x 6 in. long and is raised and lowered by power. The feeds are positive gear driven and have 10 changes ranging from $\frac{1}{32}$ to $\frac{3}{4}$ in. horizontally and from $\frac{1}{64}$ to $\frac{3}{8}$ in. in vertical and angular directions. The thread cutting arrangement is fitted to the right-hand side, and will cut from 4 to 13 threads per inch, including $11\frac{1}{2}$ per in. for pipe thread. The machine is supplied with a five step cone for a 3-in. belt. The full range of speed is obtained by changing the countershaft speed between each successive step of cone which gives 10 changes. The number of changes in speed is doubled by throwing in the back gears. The floor space required for this machine is 12 ft. x 7 ft. 10 in. The extreme height of the machine is 8 ft. 10 in. The cone pulleys are supported on both sides and are placed between the housings. The net weight is about 21,000 lbs.

(*To be continued.*)

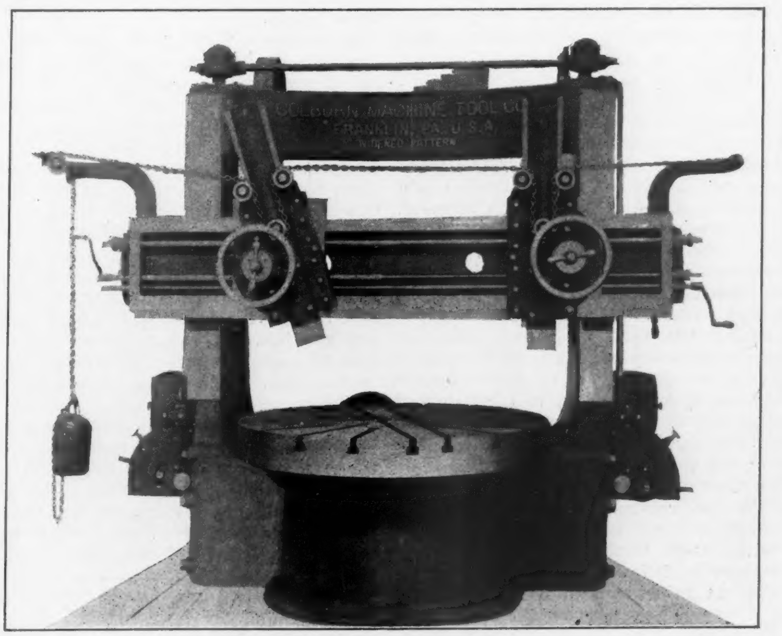


Fig. 4—The Colburn 72-in. Boring Mill.

Alternating Current for Heavy Traction.

A contributor to the *New York Evening Post* of Aug. 6 points out some of the advantages of alternating current for heavy traction. The writer who signs himself "An Old Transportation Man" is evidently familiar with the subject so that the rather liberal extract from his article which is given below will no doubt interest readers of the *Railroad Gazette*:

Main line railroad managements have during the past five years regarded electricity as a means of transportation, with a mixture of admiration and suspicion. They have first of all dealt with it as an expensive evil, but necessary to provide more comfort in tunnels to their patrons. Thus, the B. & O., to improve its Washington service and in competition with the Pennsylvania, made the start. The New York Central, warned by serious tunnel accidents, and in fear of losing its suburban travel follows suit, and finally the Pennsylvania, to make its Hudson River tunnel franchise available, could not avoid adopting this modern motive power.

While the last two improvements for terminal facilities can be considered a step in the right direction, yet their effect from a financial point of view will not be apparent for many years to come, owing to the excessive capital outlay for the type of electrical apparatus selected. This type is the direct current which requires expensive substations and conductors to convey the large amount of current needed for moving the heavy main line traffic.

The introduction of the direct current traction for this heavy traffic not only increases by about 40 per cent. the capital outlay over that required for the equipment of alternating current traction, but the operating expense necessary for turning the high voltage alternating current, as generated at the central station, into low tension direct current, would be increased over 10 per cent. This is due to the cost of power for chang-

ing the current and added cost of supervision of the sub-stations and repairs.

It has, therefore, been clear in the minds of those familiar with electric traction that the direct current system now in use, either with the overhead trolley or third rail, in moving the comparatively light units at frequent intervals on surface, suburban, interurban, and rapid transit lines, would not answer for the electrification of main-line railroads; where heavy units at long intervals have to be moved. When, however, the direct current traction has been decided on for the equipping of terminal facilities of main lines, covering a short mileage, the increased capital outlay and higher operating cost were not considered as factors in the problem.

In Europe, where these economic questions receive greater attention, the designing of an alternating current traction system was started nearly eight years ago by one of the most competent electric construction firms. Their problem was not to create an extraordinary high-speed road, which eight months ago received so much press attention, but a system which would readily adapt itself to the existing traffic conditions of any main line.

This system, installable at lowest cost, results in a great saving in operating expenses as compared with the cost of moving the traffic with steam locomotives.

This system, after having been carefully tried on a specially constructed test road, was finally placed on a main line railroad* belonging to the Italian Government. It has now been in daily operation for about three years, the entire equipment and plant having been officially received by the Italian Government in September, 1902.

An American expert, specially versed in electric traction, has recently secured an opportunity to make a most careful investigation of this system on the spot. The result of this investigation proves conclusively:

(a) The complete development of an absolutely practical system for the moving of all heavy traffic, both passenger and freight, on main line roads.

(b) That it will move such traffic with a high degree of safety, and with far more comfort to passengers than the present steam locomotives.

(c) That the cost of conducting transportation and maintenance of equipment as compared with the present cost of operating with steam locomotives would show a sufficient saving to allow the capital outlay for electrification to be written off within a reasonable time, and still leave more surplus than at present so that the distributable profit could be increased.

(d) That the roads adopting electrification could regain a part of the suburban traffic now carried by trolley lines. Such increase, or any other increase of traffic, would entail but a proportionately slight additional cost in conducting transportation.

(e) That the installation can be placed on any road without its construction interfering with the traffic.

Beyond these advantages there is another important one, and this is the reduced wear of the sub-structure owing to the balanced rotating motion of the electric motor as compared with the unbalanced reciprocating motion of the steam locomotive.

The above statements can be substantiated, and the only reasons to explain the delay in adopting these striking advantages on American roads might be the prejudice of Americans to follow European engineering, or that no prior opportunity of a minute investigation on the part of an American engineer of recognized standing had presented itself.

Of the student of political economy, the question might be asked why should the principal industries of the country battle with semi-stagnation when through a saving in the cost of one of our daily principal expenditures (cost of transportation) the means can be found to capitalize a great improvement which would distribute work to them all for many years to come and would, furthermore, enrich the country through distribution of larger profits earned by American railroads.

*The railroad referred to is the Valtellina, in Italy, which is equipped with the Ganz system. Mr. G. Leve, 114 Liberty street, New York, is the American representative of the Ganz Company.

Pile and Timber Trestle Bridges on the Santa Fe.*

While the plans of pile and timber trestles shown here differ somewhat from the preliminary plans of the Association's committee on wooden bridges and trestles, they have been based on several years of investigation and careful study of the problems involved. It is a difficult matter to get up a set of plans which are equally adapted to the local conditions on every railroad, and these are presented merely to show the standard practice of the Santa Fe and not as a suggestion for changes in the preliminary standard plans of the committee. In making up the designs here shown a set of preliminary sketches or studies was first made up and thoroughly discussed, after which came the first set of general drawings. When these had been carefully studied by the Chief Engineer of the system, they were sent to the chief engineer of each grand division with a request for criticisms and suggestions for improvement. Three of the best bridge and building foremen on the system were also called in and asked to criticise in the most severe manner possible, every part and detail shown on the drawings. After all of these final reports had been received and discussed, the present set of plans here shown were finished up.

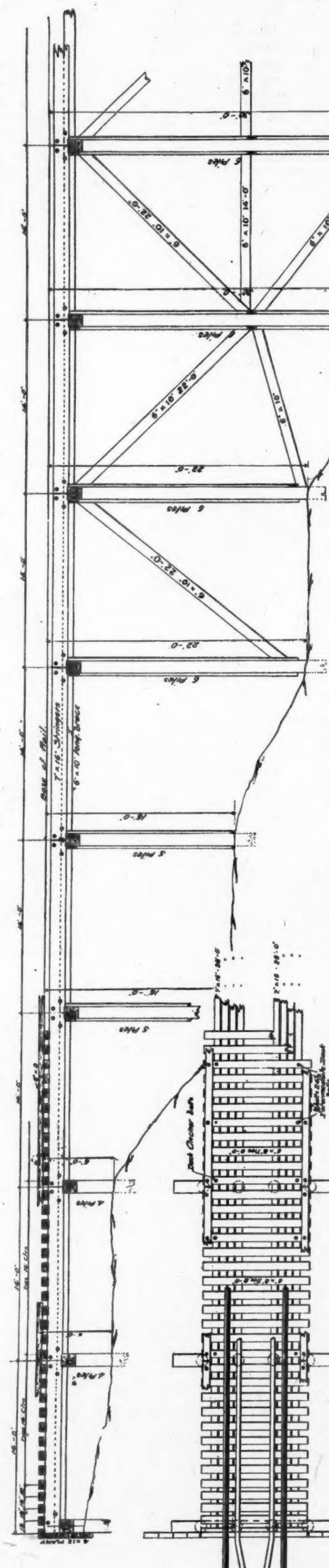
The reasons for adopting the various details shown in the plans may be briefly summarized as follows:

(a) *Guardrails.*—The timber guardrails are to be so dapped or housed over the ties that the upper surface of the traffic rails and the guardrails shall be in the same horizontal plane.

In all cases, there must be as much as 1-in. dap in order to guard against bunching of the ties. Dapping guardrails to prevent bunching of the ties is not altogether successful, no matter what may be the depth of the cut, as the projecting parts split off easily under derailments and in weathering. This, however, has been the universal practice and the writer knows of no economical method that would give better results. Usually lap splices are made, but they are very unsatisfactory and expensive. A butt splice with the extra bolt required will cost less than the half-and-half lap splice, and will give better service. The butt splice can also be made by any ordinary hatchet carpenter, while the lap splice requires a skilled workman.

(b) *Ties.*—Ties 8 in. in depth may be preferred by some, but it was considered best in the present plans to adhere to the 6-in. depth previously in use on the road. One derailment on a 6-in. soft-wood tie will cut it so badly where the wheel flanges roll over that it must be removed. An 8-in. tie would

*Extracts from a paper by A. F. Robinson, Bridge Engineer of the Santa Fe, published in Bulletin No. 53, of the American Railway Engineering and Maintenance of Way Association as an exhibit to the report of the Committee on Wooden Bridges and Trestles.



Standard Timber Trestle for Main Lines, Atchison, Topeka & Santa Fe.

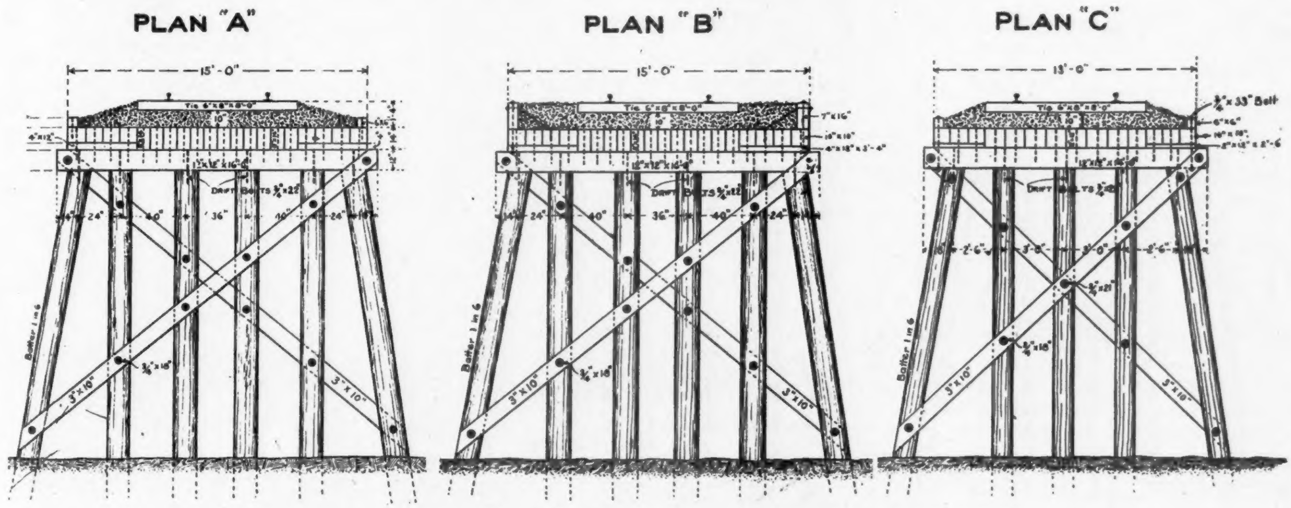
stand a more severe derailment without breaking or several derailments where the wheel flanges only cut into the top of the tie. On the Santa Fe we have not been able to obtain acceptable oak or hardwood ties for some years past at a cost that would warrant their use. At most times good hardwood ties cannot be obtained quickly, no matter what the cost may be. As to length, many engineers prefer a 12-ft. tie, while others think 8 ft. is sufficient. The length of tie shown on accompanying plans has been standard on the Santa Fe for many years. It has given good results in service and it was not deemed best to make any variation.

(c) *Stringers.*—Stringers 7 x 16 in. in cross-section have been almost universally used for so many years that they have become a regular mill size. Under these conditions they cost no more per M. feet B. M. than any other regular sizes. For the plans under discussion it was thought best to adhere to the regular size of stick already in use and to increase the number of pieces under each rail if necessary. Long leaf yellow and white pine sticks more than 16 in. in depth are expensive and hard to get; Oregon or Douglas fir will also be equally hard to obtain within a very few years. Stringer timber 8 x 18 in. costs $2.00 per M., and 8 x 20 in. $4.00 per M. ft. B. M. more than 7 x 16 in. Again, as the size of the stick increases the quality of the timber decreases, and from year to year we have found it more and more difficult to obtain the high grade of material desired even for timbers 16 in. in depth. Some engineers may consider an extreme fiber stress of from 1,400 to 1,800 lbs. per sq. in. as excessive under regular fast traffic, and 2,000 to 2,100 lbs. as altogether too much to allow. On the Santa Fe our stringers have been standing for many years under loading that causes fiber stresses of 1,600 to 1,800 lbs. per sq. in. On our branch lines, where engines are light and the number of trains per day comparatively small, our stringers last little, if any, longer than on main lines. In the above unit stresses, impact effects are not considered. A stringer may be considered as a machine which is capable of doing a certain amount of work. By the use of heavy loading and the accompanying high fiber stress, we obtain the maximum amount of work the stringer is capable of performing before it has lost very much from decay. I have never known the three or more pieces that make up a stringer or chord supporting one rail to break at the same time. In fact, I have no record of more than one piece breaking at any one time under traffic. It may therefore be assumed that so long as the percentage of broken stringers is small, we are reasonably secure, no matter whether the stringers are six years old or 12, and whether the fiber stress is 1,200 or 2,000 lbs. per sq. in. While the "Heavy Grade Loading" of our specifications for metal bridges shows extreme fiber stresses of 2,070 lbs. per sq. in. in stringers. it should be noted that 1,800 lbs. per sq. in. is the highest stress shown by any engine or car now in service. Whenever our engines reach the weight shown by the specifications above mentioned, if the percentage of broken stringers should be increased materially, we would have to increase the number of pieces used or increase their size.

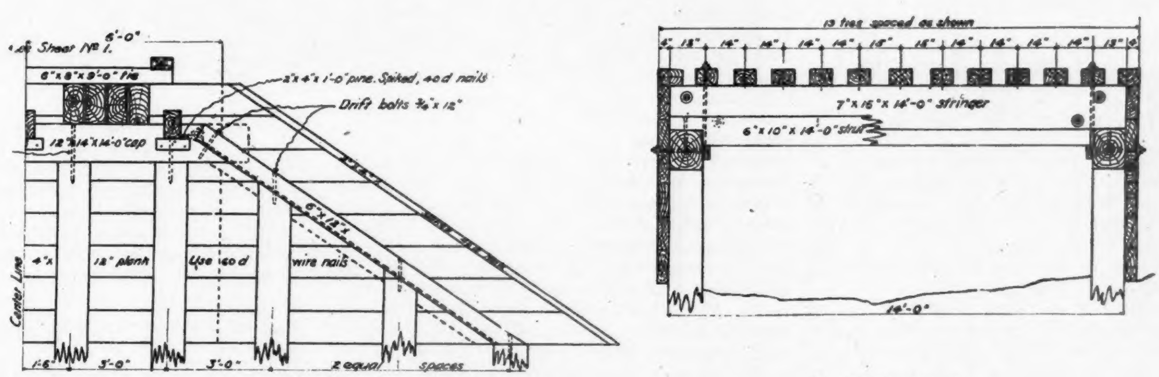
For bearing of the stringers on the caps the nominal area is 42 sq. in. per stringer, although actually it will be, in service, about 38½ sq. in., which gives a maximum load of 330 lbs. per sq. in. on the caps. So long as the bearing or crushing load on timbers such as are used in all ordinary pile and timber trestle bridges is not more than 500 lbs. per sq. in., there should be no trouble.

(d) *Bents.*—In the bents, there are three fairly well defined stresses that must be provided for. First: The transverse or lateral swinging of the engines, causing the bents to vibrate or wave from side to side. Second: The longitudinal movement caused by the tractive force of the engines. Third: The direct effects of vertical loading. The tendency would be for the first effect above noted to increase the unit stresses in stringers and bents.

In pile bents of moderate heights, as ordinarily built, no special provision is made for this twisting from the transverse and longitudinal forces. Where the bents are high the horizontal and vertical longitudinal bracing, as usually designed, is so loose that small movements in the bents will always occur, and under heavy or fast traffic these movements will always increase. Under our standard loading the piles will carry 33,000 lbs. each in four-pile bents, and 22,000 lbs. each in six-pile bents. For heavy



Cross-Sections of Standard Solid Floor Trestles, Atchison, Topeka & Santa Fe.

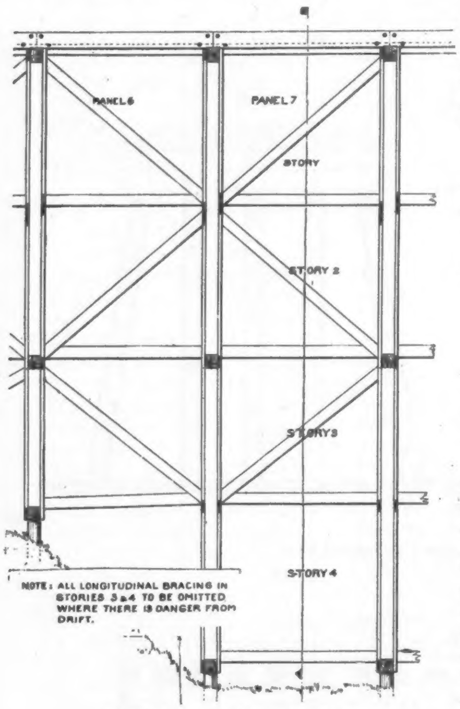


Cross Section. *Longitudinal Section.*

Standard Bulkhead and Underpass, Atchison, Topeka & Santa Fe.

grade loading the piles will carry 48,300 to 32,200 lbs. each in four-pile and six-pile bents, respectively. In both cases the stringers and caps have been considered to distribute uniformly the vertical loading between the piles in any bent, which in actual practice is doubtful. In timber bridges as usually designed the vertical loading is seldom, if ever, uniformly distributed over all piles making up the bent. For average conditions, piles carrying loads of from 15 to 25 tons each will probably not give irregular settlement under traffic.

In the plans under discussion the piles are so spaced that they can be driven (in rebuilding) without disturbing the stringers and also that the effects of loading will be uniformly distributed. As a result there



Elevation of High Trestles.

should be but little, if any, settlement in the piles, and no irregular settlement. It should be remembered that settlement of piles under traffic, and especially irregular settlement of the individual piles in any bent, is one of the most fruitful sources of high maintenance charges.

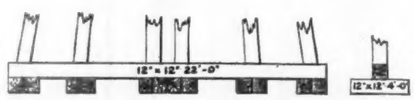
All caps and stringers have their upper surfaces completely covered with galvanized iron. This is mainly to guard against fires, but is also a protection from weather effects. In order to accomplish these objects, it is necessary that there be no open holes left in the iron where moisture could collect and start decay or coals start a fire. Our plans have no uncovered holes in the galvanized iron except where upper horizontal longitudinal struts are fastened to caps and for the passage of tie to stringer bolts. The latter are drained and covered by both the tie and the cast washers, while the former is covered by the struts. The deck anchor bolts are secured to the bents by eyebolts passing horizontally through the caps. Chuck blocks on top and sides of caps or spiked to the under side of the stringers have been unsatisfactory in the past and hurry decay. If the eye-bolt plan does not work satisfactorily we will have to adopt some other one which will.

(e) *Bracing.*—Sash and sway bracing is made up of 3 x 10-in. material fastened to the posts and piles by ¾-in. bolts. All other bracing is of 6 x 10-in. pieces arranged, as far as possible, to act in compression. All their connections with bents are forked or crotched, and the boat spikes or drift bolts are merely to keep the pieces from jarring sideways out of proper position to act to best advantage.

(f) *Bolts and Washers.*—The bolts used are all ¾ in. in diameter and the boat spikes of regular stock sizes. Drift bolts have chiseled points and end upset only enough to permit drawing with claw bar. The cast washers are 4 in. in diameter, and so designed as to reduce their weight to the least possible limit consistent with proper strength. The importance of this item will be realized when it is remembered that the ordinary O. G. washers previously in use on the road weighed from 2¾ to 3 lbs. each, while those now in use weigh 1¼ lbs. each, and that during the past few years an average of about 10,000 washers per month have been used on the system. When the bolts have a stress of 20,000 lbs. per sq. in. net, the pressure of the washers against the timber will be about 500 lbs. per sq. in.

(g) *Material Bill.*—No set of plans can be considered as complete without a full bill of material. This is especially the case where the plans are to be used over such a large territory and where the climatic and supply conditions are so varied as on the Santa Fe.

Conclusion.—While timber bridges are

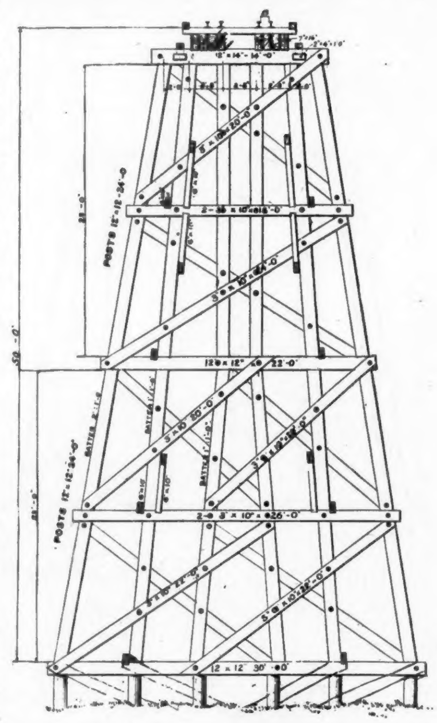


General Type Mud Sills for All Bents.

properly considered as temporary structures, they will undoubtedly be used by the railroads of this country for many years to come. It is therefore important that they be designed with due reference to first cost, probable life and average annual cost of maintenance. The writer knows of only one or two railroads in the country where what may be styled as the old time bridge carpenters are still retained, men of this grade requiring from one-third to one-half more wages than are usually paid to bridge carpenters on most lines. In designing our bridges, we have had in mind at all times the grade of labor obtainable or that it seemed to be the policy of the company to keep in their service. The system of horizontal and longitudinal vertical bracing has been so designed as to provide as far as possible against all of the small or minor movements of the structures. Very few maintenance engineers appreciate at their full value the effect of these minute movements in their structures. The writer's attempt has been to obtain at moderate cost structures that would be as nearly rigid in every particular as it was possible to make them. It is his belief that the small or minute movements of structures under traffic are the cause of the major portion of maintenance expenses, as these movements will be allowed to pass unnoticed from month to month until they have become so marked that the structure is declared unsafe, thus causing extensive repairs, which could easily have been avoided had proper provision been made originally to prevent these minute movements. Another item of considerable importance is that the number of different sizes of material required should be kept to the lowest possible limit. In the present plans, there are eight sizes of sawed timber. Only one size of bolts and washers is used, and in other particulars care has been taken to keep the details as nearly regular as possible.

In getting up new plans for timber structures, the designer should not make any more radical departures from the plans previously in use than are absolutely necessary. Structures made on the old plans will have to be maintained for from one to ten years after the adoption of the new ones. Any changes in the sizes of material will be liable to cause confusion in the field, and will also necessitate the Store Department keeping on hand a supply of material to agree with both the old and the new plans.

The bents and bracing for branch line structures are lighter than those for main line traffic. On many of our branch lines where the light engines are used, it will not be necessary for the heavy stringer chord to be used for some years to come. When-



Cross-Section of High Trestles.

ever traffic requires, the extra line of stringers can be put in without disturbing the deck and at a very moderate cost.

The plans for creosoted ballasted deck trestle are shown with the other work in order to present the whole scheme together.

The New Fraser River Bridge.

The bridge across the Fraser River at New Westminster, British Columbia, which was described in the *Railroad Gazette*, Aug. 29, 1902, was opened for traffic with appropriate ceremonies on July 23. It was built by the Provincial Government and cost about $1,-000,000. New Westminster is situated on the north bank of the Fraser river, about 15 miles from its mouth. The Vancouver line of the Great Northern runs along the south bank and across the river farther up, and a branch of the Canadian Pacific from Westminster Junction on the main line runs along the river's edge into the town. The new bridge, which is a double-deck structure, carries vehicles and foot passengers on the upper deck and has one track for steam and electric cars on the lower deck connecting the two lines of railroad on both sides of the river and giving the Great Northern an entrance over the Canadian Pacific tracks into the heart of the town.

The Fraser river at this point is 2,100 ft. wide at a mean stage of water, and the tidal

difference is about 14 feet between high and low water. The new bridge is a steel structure supported on masonry piers, and consists of one through truss fixed span of 225 ft., one through truss fixed span of 380 ft., one through truss swing span of 380 ft., and five through truss spans of 159 ft. each. The five short spans carry the carriage roadway on the top laterals, the trusses being made only deep enough to give 16 ft. headroom for the railroad tracks on the lower deck. In the other three spans the roadway deck is 16 ft. below the top laterals, supported on floorbeams connected to the posts of the trusses. Beginning at the first pier from the north shore the railroad track branches out into a Y, with 12 deg. 30 min. curves, to connect with the tracks of the Canadian Pacific which run along the river's edge, and the inshore span is widened out to 135 ft. 6 in. at the shore end to give the necessary spread for the curves of the Y. The railroad approaches at this end consist of one deck plate-girder skew span of 90 ft., two through plate-girder skew spans of 53 ft. 6 in. each, and one deck plate-girder skew span of 41 ft. for the east approach, and one deck plate-girder skew span of 71 ft. 6 in., one through plate-girder skew span of 43 ft., one through plate-girder skew span of 38 ft., and one deck plate-girder skew span of 32 ft. for the west approach. The wagon approach on the north side is from a high earth embankment over short plate-girder spans supported on steel bents to the main spans of the bridge. On the south side a wooden trestle carries the roadway, steam and electric tracks down to their respective connections. The total length of the steel work in the bridge is 2,400 ft., of the railroad approaches 7,715 ft., of the roadway approaches 1,870 ft., and of the bridge and all approaches 11,985 ft. About 4,000 tons of steel in all was required.

In the substructure there are 11 piers, 12 pedestals and three abutments. Piers 1 to 5 were sunk to bed rock by open dredging, and piers 6 to 11 are concrete and masonry shafts resting on timber cribs filled with concrete and piles. The deepest pier was sunk 141 ft. below high water and penetrates the river bed 69 ft. The draw span pivot pier has a penetration of 90 ft. into the river bed.

The bridge was designed and built under the supervision of Messrs. Waddell & Hedrick, Kansas City, Mo. Armstrong, Morris & Balfour, Vancouver, B. C., were the contractors for the substructure and approaches, and the Dominion Bridge Co. (Ltd.), Montreal, was the contractor for the superstructure and erection. Work was started in August, 1902, and was finished just previous to the opening.

New Bridge over the Fraser River at New Westminster, B. C.

A Review of the Cast Iron Wheel Situation.

BY C. W. GENNET, JR.

When the demand was made for a car wheel capable of withstanding an increase of from 40 to 60 per cent. of the load calculated for it to bear, the thought did not simultaneously occur that existing standard designs were inadequate. The familiar 600-lb. chilled iron wheel had for years given the best of service as regards safety and economy of operation, and a departure from the regulation design of tread, flange, brackets and plates appeared radical and unnecessary. Thus when the 30-ton capacity car grew into one of 40, and then into one of 50 tons, the natural and guiding impulse was to simply add 50 or 100 lbs. to the weight of the cast-iron car wheel, pains being taken at the same time to systematically distribute this additional weight to such parts as would seem the best and the easiest of adaptation for the increase.

In some cases the thickness through the tread was increased, but almost without exception the alterations adopted were in the thickness of the plates, in the dimensions of the hub and in the number of the brackets. Within a short time trouble began to occur abundantly. Particularly on mountain roads, where either the number of grades compelled frequent action of the brakes or where there were many curves, wheels began to show signs of weakness under the heavy loads. Flanges began to break off and wheels burst, and in both cases the occurrences were generally accompanied with much damage. This result, which was perhaps invited, has been the subject of much agitation, not only among railroad men in general, but also among wheel makers, and the resultant co-operation has been productive of many new designs and improvements which, if adopted, should eliminate much of the trouble.

It is assumed that, by reason of an active and well maintained inspection of wheels previous to their being put into service, which compels the rejection outright of such lots of wheels as fail to stand the required tests, that only those entirely free from defects are allowed to be used. Moreover, it is assumed that a vigorous inspection of wheels under cars precludes the possibility of further use of defective wheels according to the Master Car Builders' rules.

Two expressions are usually employed to describe the breaking of wheels in service, viz., "flanges breaking" and "wheels bursting." The first class of failures has its origin in the fracture of a small piece of the flange, which break sometimes occurs a long distance from the scene of the final disaster. Then, as the wheel continues to revolve, the weakened flange often creates a hammer blow on the rail with the continuing effect that with each revolution the break is increased until finally the entire wheel is more or less demolished. The reason for this class of failures, that is, what causes a piece of the flange to first break off, has been variously explained; but where no inherent defect is apparent the theory is that a combination of the heating effects produced by the grinding action of the flange on the rail and by the action of the brakes causes an uneven or unequal expansion and contraction of the metal, which ultimately causes cracks running longitudinally around the wheel in the throat and which so weaken the metal that failure results.

To this class of failures is closely allied the other, that of wheels bursting; but the cause of the latter is not supposed to originate in a weakening of the flange. The action of the brakes in continually heating the tread of the wheel and the subsequent cooling that ensues is regarded more than the flange action on the rail as the primary cause of a crack running from the throat across the tread. A weakening effect thus spreads through the tread and finally into the plates, so that the wheel is generally broken clear through, as in the thermal test.

The production of heat that comes from either the grinding action of the flange on the rail head or the continual application of the brakes, or both, is regarded as the real source of the trouble. This heating effect is generally indicated afterward by a deep bluish color given to the metal in the broken wheel. As insignificant as it may be considered, it constitutes a never-ceasing menace. Some idea of the degree of heat produced can be gathered from an attempt to hold the hand on the flange of a trolley car wheel after it has rounded several curves, and, while this heating is small in comparison to that produced by a heavy car descending a grade on a curve, the effect is sufficiently startling to convey an impression of its intensity.

Highly interesting experiments with wheels subjected to a process slightly differing from the regular thermal test have shown that the action of heat around the periphery of a cold wheel may produce a crack in the chilled iron which, by not extending to the surface, is consequently invisible to the most careful surface inspection, but which by its very existence materially weakens the value of metal in the throat. It is a fact that of the two classes of failures, those of broken flanges have been in the majority with the use of heavy cars, so that it is a reasonable supposition that this is the part which requires the most attention. To effect a correction in this vital part of the wheel is an extremely difficult problem; for, with the numberless frogs and switches of almost universal dimensions, the prime requisite, which seemed to be to increase the thickness through the flange from the throat, was obviously impossible.

Although it was at first conceded that an increase in weight of a car wheel of 16 per cent, was insufficient to withstand an increase in its loaded rating of 60 per cent., the makers were able, in a measure, to meet this objection by asserting that, if properly paid for their efforts, they could produce a wheel of such quality of iron that its effectiveness at a comparatively small increase in weight would be thoroughly satisfactory. Whether doubt of their ability to do this or unwillingness to pay the price demanded, can be taken for the reason, it is known that generally their offer was not accepted. At the same time the merits of steel-tired wheels were discussed, and although their large factor of safety as shown on passenger equip-

ment was an argument for their further use, their great cost necessarily rejected them for freight use. As a matter of interest, it has been shown that even under passenger equipment the use of steel-tired wheels fails to show primary advantages. Perhaps their adoption for Pullman cars has been their best recommendation, for the comparative figures of various companies show no decrease in cost of maintenance over cast-iron wheels, and, as has been stated, the first cost is much greater. In other respects records show that a small guarantee is offered by the use of steel-tired wheels, and it is quite apparent that any favor for their use has been founded on the fact of their being steel instead of iron.

Improvements in designs of cast-iron wheels have been almost entirely along such lines that the price has not been increased beyond that required by the slight addition of weight. In almost every case the fundamental idea has been to strengthen the flange and in this direction four primarily different styles have been devised. The first to make its appearance consisted of simply a projection on the inside rim of the wheel back of the flange. This projection was so shaped that the thickness of the rim back of the flange was increased, the projecting form being rounded off to meet the rim again at a point back of the throat. Undoubtedly a step in the right direction, the effect of this addition was not spontaneously proven, for the difficulties which attended making such a casting with the necessary chill, led to some apprehension.

A change more generously adopted has been to increase the radius in the throat of the wheel and at the same time maintain the other characteristic dimensions. This radius, long ago set by the Master Car Builders at five-eighths of an inch, has been increased to as much as fifteen-sixteenths in the wheels of such weight as selected for the heaviest cars. By this alteration, the depth of chill can easily be kept at the desired amount, and the wheel thus made is exactly according to the best-known standard designs, excepting that the metal through the throat has been increased about one-eighth of an inch. The fact that the greater radius increases the tendency for the wheel to mount the rails has not been considered hazardous, for the change in the curve of the throat outline is so slight that the design is believed to be still well within the limits of safety.

More radical than either of these designs has been that of a proposed single-plate wheel, and another which has a projecting ring of rib-like section placed on the inside rim in such a position that, while it comes directly over any guard rail or switch point it easily clears. This latter wheel is supposed to strengthen by reinforcing, and as the idea seems to possess no detrimental features the design may come into more general use. The former wheel is made with a single plate extending with a reverse curve from the outside of the hub to the inside of the flange. Ribs, alternately placed on the outside and the inside, connect the plate with the rim and the hub, and besides the feature of strength which is claimed for the flange thus connected, the wheel should offer none of the defects sometimes found in those double-plate wheels made with cores.

While these forms of wheels have been designed with a view to reinforce the weakest part and thus to eliminate troubles which have occurred, their use to the present time has been limited to such an extent that any accurate data as to their success as a whole is impossible to obtain, and the adoption of any one form is a matter largely of personal favor. While these forms do somewhat increase the actual weight of the wheels beyond that which are customarily used for the various capacities of cars, still this increase is not enough to make it a very important item of expense, and the benefits to be derived are believed to be so great as to justify their careful consideration.

Efforts to increase the efficiency of wheels have also been made with the use of cast steel in place of iron. Several years ago there was put on the market a single-plate wheel made from a steel casting, which had the regular form and shape of standard wheels, but was deficient in not having a smooth and entirely circular tread. This rough casting was heated and revolved with rollers pressing on the tread and flange, so that when finally finished the effect was a tread and flange as neat and accurately formed as is generally found with cast-iron wheels. These wheels are reported to have given first class results, but their cost, though not quite equal to that of the usual rolled steel tired wheel, has been so great as to not permit of their extended use.

Another form has been made which has for its fundamental principle the extreme hardening of the metal composing the flange and tread by the addition of manganese to the steel. This wheel has its single plate formed like a folding fan; that is, the folds or corrugations radiate from the hub, and give an appearance of much strength to the wheel. Wheels produced in this way are extremely hard, as proved when submitted to the drop test, and that this hardening does not indicate brittleness is shown by the manner with which they have withstood the thermal tests.

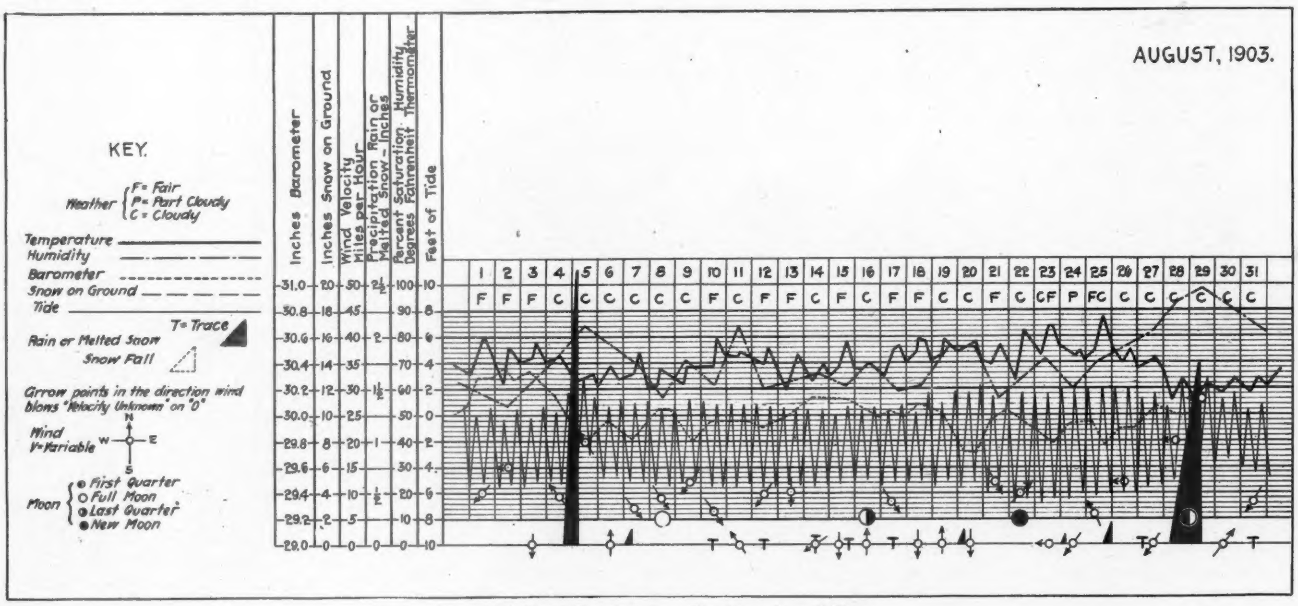
Within the last year experiments have finally succeeded in producing a wheel made of steel, by combined pressing and rolling. In this, the steel ingot is first pressed into shape and then successively rolled to give it the required finish.

With these different forms available, wheel makers and users are struggling for results, and how their efforts are best succeeding must be left for time to tell. The great question is whether or not experience will demonstrate that the cast-iron wheel must give way to steel, and the matter of expense will have relatively slight influence on the decision, if other requirements demand the change.

Engineering Office Weather Records.

The accompanying cut illustrates a form of weather record which is prepared with little trouble and which has been found most satisfactory, as being easily referred to, and giving at a glance the condition for each day. While it is not supposed that offices are as a rule equipped with instruments for recording the various phases of the weather, it is customary for one or more of the daily papers to publish a tabulated weather report, which is always available in the neighborhood of large cities. These newspaper reports may be augmented by the daily weather bulletin issued by the United States Government, which is always accessible. When the work is at tide water, the tide record may be supplied from the nearest, self-recording tide gage, as the records are usually available at the office of the department of docks, or the tide may be plotted from observations by the inspector.

The scale adopted for the record is such that extreme refinement in plotting is not warranted, it being sufficient to plot the maximum and minimum values at the time of occurrence each day. The record is plotted on thin profile paper, from which blue prints may be taken.



A Graphic Weather Record for Engineering Offices.

GENERAL NEWS SECTION

THE SCRAP HEAP.

On representations from the railroad companies that times are hard, the Railroad Commission of Texas has suspended its order of June 24 requiring the construction of interlocking signals at sixteen grade crossings. Chairman Storey recorded his disapproval of the order.

The controversy between the Pennsylvania Railroad and the Western Union Telegraph in the courts is still kept up. At Pittsburg last week the railroad company filed a bill in the United States Circuit Court to restrain the telegraph company from using the lines along the Cleveland & Pittsburg.

At St. Louis, July 29, E. J. Gildersleeve, who had just completed serving a fifteen days' sentence in jail for contempt of court, was sentenced to 60 days, with a fine of $300, for violating another injunction forbidding him to deal in non-transferrable World's Fair excursion tickets. Herman Schubach was sentenced to ten days in jail and to pay $250 fine.

A press despatch from Buffalo says that at a meeting of passenger representatives of the principal Vanderbilt lines in that city last week a proposition to discontinue running Sunday excursion trains was favorably considered. The Lake Erie & Western, controlled by the Lake Shore, has already announced that no more excursions will be run on Sundays.

The New York, New Haven & Hartford has restored 15 of the 35 trains which were taken off July 24, and has made changes in others. This has partially appeased the complaining passengers, particularly at the summer resorts on the Sound, but in many towns and cities the people who complained, going to the extent of holding public meetings and enlisting the active co-operation of city governments, are still nursing their grievance. The officers of the railroad say that the trains taken off had been making their trips day after day with as few as 15 passengers.

An officer of a western road writes that the reports of recent flood damage have been considerably exaggerated. There was some damage from high water and delays to trains and, of course, damage to crops to some extent, but when the whole section is taken into consideration the damage, in his opinion, really amounts to but very little. He says, further: "We have the finest wheat crop in all sections of the Dakotas and Minnesota that has ever been known. For the first time in the history of those states the dry portions are going to yield a crop equal to the better portions of the states. The only thing that we are fearing now is that the corn crop in Iowa, Nebraska and Kansas may not mature because of cool days and nights, but there is ample opportunity for hot weather to come and if it does come and stays there can be no question but what the crop movement will tax the railroads for the next 12 months."

Near Notasulga, Ala., on the Western Railway of Alabama, recently, a boy only eight years old distinguished himself by flagging a passenger train; and he didn't have to do it with his sister's red petticoat, either. He was posted as to the rules and used a red flag and torpedoes in regulation fashion. A violent wind and rainstorm arose one afternoon near the boy's home and blew down two telegraph poles so that they lodged across the main track. Passenger train No. 33, from Atlanta to Montgomery, was due about that time and the boy, who is a son of Section Foreman Cogburn, and who is familiar with his father's work, seeing the possible danger to the oncoming train, lost no time in snatching up a red flag and a string of torpedoes and starting up the track. The line at that point is straight and in all probability the engineman would have seen the obstruction in any event; but the wit and energy of the boy are worthy of notice nevertheless. It took the trainmen about 10 minutes to clear the track.

The general manager of the Consolidated (street) Railway Co., of New Haven, Conn., has announced to the conductors and motormen of the company that during the next twelve months a careful record will be kept of their conduct and that at the end of that time two funds of $500 each will be divided amongst those who come out with clear records. If all fall short, the money will be divided among a limited number of those who have the fewest demerits charged against them. This announcement was made at the close of a little lecture on the men's faults, in which the manager rehearsed the principal kinds of misconduct that had recently called for censure or criticism. In this lecture, after recounting the most common lapses of conductors and motormen, the speaker continued: "The failure of certain conductors to register their fares has become very serious in some cases, and has got to be stopped. I shall endeavor to get absolutely conclusive evidence and no conductor will be discharged for this cause without careful investigation." The meeting at which this lecture was given was not held on a Sunday but on Tuesday afternoon; nevertheless it was opened with prayer by the Rev. Mr. Irvine.

Abolishment of Grade Crossings in Brooklyn.

The Grade Crossing Commission in Brooklyn has reached an agreement with the Long Island railroad for abolishing all grade crossings on the railroad between Bay Ridge and the borough line of East New York. According to the terms of the agreement, the city must pay a certain proportion of the expenses up to $2,500,000. After it has expended this amount its financial obligation ceases and the Long Island railroad must bear the remainder of the expenses. This agreement is in addition to plans which have already been approved by the Commission providing for the abolishing of all grade crossings on the Brighton Beach Division of the B. R. T. Work on this is now under way and includes the doing away with 21 grade crossings. The share of the city expenses in this latter work is $750,000.

Rail Motor Cars at Plymouth, England.

A new service of rail motor cars has been established by the Great Western railroad between Plymouth and Plympton and Plymouth and Saltash. The cars, comfortably fitted, are built on the Pullman plan. Each car is 57 ft. long, 8 ft. 6 in. wide, and 8 ft. 2 in. high, supported on two trucks, the wheels of which are 3 ft. 8 in. in diameter. Seating accommodation is provided for 50 passengers, who enter and leave at one end of the car, while the other is partitioned off to inclose a vertical boiler. This stands directly over the truck which provides the four coupled wheels of the engine. The latter consists of two outside cylinders, 12 in. in diameter with 16 in. stroke, and are fitted with Walschaert's valve gear. The boiler is 9 ft. 6 in. high and of 5 ft. mean diameter, with 477 vertical tubes, and carries a working steam pressure of 185 lbs. per square inch. Each car, which is lighted with oil gas, represents a cost of $9,733. The cars can be driven from either end, there being a glass lookout at each. The motor can develop sufficient power to draw an ordinary railroad car as a trailer.—*Consular Report.*

Illinois Coals.

A bulletin from the University of Illinois states that the University Studies No. 7 has just been issued, bearing the title "The Coals of Illinois; Their Composition and Analysis." It is by S. W. Parr, Professor of Applied Chemistry, and is said to be by far the most comprehensive work so far undertaken on Illinois coals. One hundred and fifty samples fairly representative of the coal-producing area have been studied and the results conveniently arranged in a table for reference. Several unique features are mentioned. The samples collected between January and June, 1904, were subjected to the same processes carried on by the same persons; the results therefore are more uniform and comparable than any heretofore available. Another interesting feature is the introduction here for the first time of a new factor in the proximate analysis of coal, that of "water of composition" as part of the volatile constituent. It is a little startling to see a non-combustible as part of the volatile matter, equaling and often surpassing in amount the sum of the ash and moisture. Special development has been made, also, of processes for determining the total carbon, sulphur and coke. The work is considered a valuable contribution to the knowledge of bituminous coals in general and Illinois coals in particular.

German Railroads and Railroad Traffic.

The mileage of the German standard-gage railroad was 26,637 miles at the end of 1892 and 32,242 miles at the end of 1902, an increase of 21 per cent. Of the mileage in 1892, 24,145 miles, or 90.6 per cent., were State railroads, and 2,492 miles, or 9.4 per cent., were private roads, while in 1902, 29,394 miles, or 91.2 per cent., were State railroads, and 2,848 miles, or 8.8 per cent., private roads. In 1892, 15,543 miles, or 73.4 per cent., were main lines, and 7,094 miles, or 26.6 per cent., were local lines; in 1902, 20,284 miles, or 62.4 per cent., were main lines, and 11,958 miles, or 37.1 per cent., local lines.

The receipts from passenger traffic in 1902 were $136,561,600, against $87,960,400 in 1892, an increase of 57 per cent. The receipts from freight in 1902 were $311,601,600, against $219,218,400 in 1892, an increase of 42.1 per cent. The total receipts, exclusive of lease interest, increased from $322,833,600 in 1892 to $485,131,800 in 1902, an increase of 50.27 per cent., while the mileage had increased but 21 per cent. The interest earned upon the invested capital of the lines operated was 4.70 per cent. in 1892 and 5.50 in 1902. The number of officials and employees, inclusive of artisans, apprentices and women, was 545,182 in 1902, against 417,360 in 1892, an increase of 30.6 per cent. The salaries and wages for officials and other

employees amounted to $183,[illegible]04,800 in 1902, against $121,392,000 in 1892, an increase of 51 per cent., against an increase of 30.6 per cent. in the number of such officials and other employees. The average wages for each of these increased from $290.88 in 1892 to $336.24 in 1902, an increase of 15.6 per cent. The rolling stock in 1902 consisted of 20,296 locomotives, 46 motor cars, 41,215 passenger coaches, and 424,017 baggage and freight cars. Compared with 1892, the number of locomotives increased 31.15 per cent., the number of passenger coaches 42.61 per cent., and the number of baggage and freight cars 37.52 per cent.—*Consular Report.*

Steel Rail Output.

Revised estimates of the production of steel rails in the calendar year places the total at 1,450,000 tons as the maximum. Of the total approximately 300,000 tons will be sent abroad so that the railroads of the United States will consume not to exceed 1,150,000 tons of rails in the calendar year, for which the steel companies will receive approximately $32,200,000 gross.

Last year the total output of steel rails was 2,813,583 tons, worth gross to the makers at $28 per ton, a total of $78,780,324. Because of the fact that less than 40,000 tons were exported and that for what was sent abroad the average price was in excess of the domestic schedule the entire output is treated as domestic.

This year the steel rails exported are not bringing within $5 per ton of the domestic price, so that while on the estimate of 1,450,000 tons output, the gross receipts to the railmakers should be $40,600,000, it will be somewhat less. Allowing $40,600,000 to stand as a basis of comparison, the tremendous decrease in rail demands from the railroads for this year is shown to be $38,180,324. Not since 1897 has the production of steel rails fallen below 1,600,000 tons and this year's production will mark the low point for the ten year period starting with the Bryan free silver campaign in 1896. Assuming the estimate for the year to approximate actual results, the comparisons for the ten year period show as follows:

Year.	Output Tons.	Price Per Ton.	Total Value. Gross.
1904........	1,450,000	$28.00	$40,600,000
1903........	2,813,583	28.00	78,780,324
1902........	2,876,293	28.00	80,536,204
1901........	2,836,273	27.33	77,514,241
1900........	2,361,921	32.29	76,266,429
1899........	2,270,585	28.12	63,848,850
1898........	1,976,702	17.62	34,829,489
1897........	1,644,520	18.75	30,814,750
1896........	1,116,958	28.00	31,274,824
1895........	1,299,628	24.33	31,619,941

The table shows that the four lean years in railroad demands 1895 to 1898 inclusive, were worse than the present year in production and in gross receipts from rails, while only in 1896 was the lean year price as high as the present $28 a ton schedule. In 1899 when the real boom in steel rails was inaugurated, the roads took 2,270,585 tons, paying $28.12 per ton for them, a gross total of $63,848,850. The next year 1900, the roads increased their rail consumption to 2,361,921 tons, while the rail makers popped the price up to $32.29 per ton, making the total cost to the roads $76,266,429.

The height of the ten year period was reached in 1902. The roads that year took 2,876,293 tons at $28 per ton, making their total rail bill from domestic mills $80,536,204. There have been five lean years in rail consumption within the decade—1895 to 1898 inclusive, and 1904—while the fat years have also numbered five—1899 to 1903 inclusive. Whether 1905 will be a fat year for rail makers rests entirely with the railroads of the United States. It has been demonstrated by this year's figures that the steel rail export trade is not profitable. When the domestic roads refuse to buy it is generally true that the railroads of other countries are in none too prosperous a condition. It is also true that when the rail mills are bare of domestic orders export orders are taken at about cost.

The table of rail exports for the last three fiscal years is recapitulated for the purpose of showing what a slender reed is reliance upon foreign orders for American steel rails:

	Tons.	Value.
1904.................	160,894	$4,253,376
1903.................	22,896	710,886
1902.................	166,816	4,613,624

The indications are that the railroads will in 1905 use a large tonnage of rails and track materials and supplies. But the principal roads have not placed their orders for next year's delivery and until they do, there is no tangible basis for making calculations, estimates or prophecies.—*Wall Street Journal.*

Railroad Extension in Bolivia.

The Peruvian corporation owning and operating the Southern Railroad of Peru, from Mollendo on the Pacific to Puno on Lake Titicaca, and operating lake steamers in connection therewith between Puno and Guaquai, has acquired control and taken possession of the Guaquai-La Paz (Bolivian Government) railroad from Guaquai to the city of La Paz, for the term of seven years from June 1, 1904. The corporation lends the government £50,000 ($243,335) at 6 per cent. interest, for the completion of the extension of the Guaquai-La Paz line from the Alto to the city of La Paz, and the government recognizes its present indebtedness to the corporation of something more than £23,000 ($111,930). The corporation will retain 60 per cent. of the revenues of the railway for operating expenses during the term of its lease. The extension from the Alto will be an electric line 4.9 miles in length, with a 6 per cent. grade and 39.37 inches gage, the same gage as that of the main line, and will be completed within about twelve months. All of the material and equipment for the construction and operation of this extension will be obtained from the United States. By the acquisition of the Guaquai-La Paz Railway, the Southern Railroad of Peru secures a continuous service from Mollendo, Peru, to La Paz, Bolivia.—*Consular Report.*

Manufacturing and Business.

John F. Starr, founder of the Starr Foundry Co., now the Camden Iron Works, died in Atlantic City, age 86 years.

The Ohio Construction & Engineering Company, of New York City, has been incorporated with a capital of $25,000 in New York. The directors are: I. C. Darling and T. D. Barrett, of Cleveland, Ohio, and E. W. Clement, of Buffalo, N. Y.

The ship yards at the foot of Arrietta street, Tompkinsville, Staten Island, belonging to James McLean, and one of the docks of the Staten Island Rapid Transit Ferry, on which stood a store house, were destroyed by fire August 7 at a loss of about $38,000.

W. H. Whiteside, General Manager of Sales of the Allis-Chalmers Co., has been appointed General Manager of Sales of the Bullock Electric Manufacturing Co. He will have entire charge of the Sales Department of both the Allis-Chalmers and Bullock organizations.

The Advance Signal Company, of Newark, has been incorporated in New Jersey with a capital of $100,000 to make and sell railroad signals. The incorporators are: J. H. Fleming, of Newark; J. Rogers Westerfield, of New York, and Herbert B. Taylor, of East Orange, N. J.

The Thomas Crimmins Contracting Company has been incorporated in New York with a capital of $250,000 to carry on a general contracting business and to build bridges, railroads, etc. The directors are: Thomas E. Crimmins, David Crimmins and Edward J. Shafer, all of New York City.

The Duff Manufacturing Co. has received another order from the Trans-Siberian Railways Co., Russia, which is an addional order to the carload order of Barret track jacks shipped to them some time ago. The company has also shipped a number of jacks to Egyptian railways, at Alexandria, Egypt.

Major J. C. Case, U. S. A., City Engineer of Manila, P. I., has submitted to the Secretary of War plans for water supply and sewerage. They provide for bringing water to Manila by gravity through a pipe line from the head of Maraquina valley, 16 miles, at a cost of $2,000,000. Bonds have already been authorized and the Secretary of War will now arrange for the letting of contracts.

The Wellman-Seaver-Morgan Company, of Cleveland, Ohio, it is said, has been awarded the contract for building complete the new rail mill for the Dominion Iron & Steel Co., of Sydney, Nova Scotia, to be delivered inside of 90 days. The same company has also a contract for extensive work in Nova Scotia for the Nova Scotia Steel & Coal Company, being engineers for the new steel works.

The Montgomery Bridge Co., of Montgomery, Ala., has been organized with a capital of $150,000, to build a steel highway toll bridge over the Alabama river at a point between Montgomery and the junction of the Coosa and Tallapoosa rivers. George E. Mattice, of Chattanooga, Tenn., is Treasurer. The directors include: William H. Hewitt, W. O. Burks and C. S. Stewart, all of Chattanooga.

Bids are wanted August 15 at the office of the City Controller of Port Huron, Mich., for furnishing all material and labor for the uncompleted portion of the canal from Lake Huron to Black river. The work includes about 300,000 yds. of excavating, a double-track railroad bridge, one highway bridge (iron on the ground), water gate at Lake end, and about 100 ft. of protection pier. R. D. O'Keefe is Superintendent of Public Works.

The Morse Dry Dock & Repair Company, of Brooklyn, N. Y., has been organized and is practically a reorganization of the Morse Iron Works & Dry Dock Co., which went into the hands of a receiver in October last year. The new company will have a capital of $600,000 and will build ships and vessels of all kinds. The directors are: Daniel J. Leary, E. P. Morse, John P. Caddagan, George Leary, of Manhattan, and Wm. C. Reid, of Brooklyn.

Four new companies have been organized by the United States Steel Corporation for the purpose of holding and acquiring ore lands in Minnesota. The companies are: The Braddock Iron Co., the Duquesne Iron Co., the Homestead Iron Co. and the Allegheny Iron Co., each with a capital of $50,000, and all of them with headquarters at Duluth. It is understood that the companies were formed for the purpose of leasing ore lands in Minnesota under the liberal laws governing leases by the State Government to home corporations.

At the Saratoga convention of the American Street Railway Association last year a committee of five was appointed to organize an association of manufacturers to take care of the exhibits at the annual conven-

tions. The result of this committee's work has been the formation of the Manufacturers' Committee of the American Street Railway Association, of which Richard W. Meade, 621 Broadway, New York, is Secretary. The new organization will hold a convention at the St. Louis exhibition on October 12 and 13. At this meeting there will be no exhibits.

A circular has been sent out to the stockholders of the Westinghouse Electric & Manufacturing Co. announcing that opportunity will be given to subscribe to $2,500,000 of new stock at $80 a share, the par value of each share being $50. The objects of the stock issue, as outlined in the circular, are: To provide in part for an investment in the bonds and stock of the Lackawanna & Wyoming Valley Rapid Transit Co.; for the purchase of debenture stock of the British Westinghouse Electric & Manufacturing Co., Ltd.; for the purchase of valuable electro-pneumatic train-control patents, and for other capital for expenditures. Subscription must be made before August 15.

In the Mining Gulch at the World's Fair in St. Louis, two exhibits, that of the coal testing plant of the United States Geological Survey and the timber preserving plant of the Bureau of Forestry, will depend for their operation largely upon the machinery loaned by the Allis-Chalmers Co. A 250 h.p. horizontal Allis-Chalmers engine will supply power for the mechanical operations to which the samples of coal will be subjected. The timber preserving plant is under the direction of Dr. H. von Schrenk. Its special work will be to test methods of preserving railroad ties. The Allis-Chalmers Co. has supplied at its own expense a tie treating retort and two tanks for the preservative solutions for these testings.

The Wellman-Seaver-Morgan Company, Cleveland, O., has just been awarded a contract to furnish the Wellman-Street cast-steel truck bolsters for 800 cars to be built by the Norfolk & Western Railway Company, the whole order amounting to 550 tons of steel castings. Each bolster consists of one open hearth basic steel casting, having side bearings and center plates cast complete. Of the 800 cars, 200 will be hopper coal cars of 50 tons capacity, having steel under frames with wood lining, and will be built at the company's shops at Roanoke, Va. The remaining 600 cars will be box cars 40 tons capacity, having steel under-frames, and will be built by the American Car & Foundry Company at Huntington, W. Va.

Iron and Steel.

It is reported that the Pittsburg Steel Co. has bought from the Bessemer Steel Co., the Republic Iron & Steel Co., M. A. Hanna & Co., and other furnaces approximately 110,000 tons of standard Bessemer pig iron, to be delivered between September 1, 1904, and June 1, 1905. Although no division of sales has been officially made, it is stated that, of this total amount, the Bessemer Pig Iron Co. sold 50,000 tons, and M. A. Hanna & Co., 35,000 tons, and the order for the remaining 25,000 tons was divided among several smaller furnaces.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 30.)

The National Railroad Master Blacksmiths' Association.

At the twelfth annual convention of this association, to be held at the Grand Hotel, Indianapolis, Ind., August 16, the papers to be presented include the following: Tools and Formers for Steam Hammers on General Railroad Work; Spring Making, Repairing, Tempering, etc.; Tool Steel Forging and Tempering, including High Speed Variety; Best Method of Testing Material; Best Material and Method of Forging Motion Work; Best Form of Oil Furnace; Frame Making and the Best Material and Methods for Preparing the Same from Scrap; Repairing Locomotive Frames.

PERSONAL.

—Mr. Halbert S. Kerr has resigned as General Superintendent of the San Pete Valley Railway, with office at Manti, Utah, to accept the appointment of General Manager of the Cerro de Pasco Railway, which is building in Peru. The road is being built by the Haggin-McCune syndicate to reach and develop its vast copper mines, and branches are to be built to coal mines and other places. Mr. Kerr is a native of Maryland, but at an early age went to Utah to enter the engineering field with a Denver & Rio Grande party, and later was employed with other lines.

—Mr. James M. Boon, formerly Superintendent of Motive Power of the West Shore Railroad, died in Chicago on July 31, at the age of 71. Mr. Boon retired from the service of the West Shore (New York Central) about six years ago after an active railroad service of 48 years. Before going to the West Shore he had served on the Pennsylvania, the Kansas Pacific, and the Chicago & North Western. He was one of the earliest and most active and influential members of the Master Mechanics' Association. He was prominent on many committees and was both an able executive officer and an accomplished mechanic.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—A. Harrity, Division Master Mechanic at Raton, N. Mex., has resigned. (See Gulf, Colorado & Santa Fe.)

Atlantic Coast Line.—On the 28th of last month the railroads and other property of the Jacksonville & Southwestern were conveyed to the Atlantic Coast Line; and since Aug. 1, the J. & S. W. has been a part of the Second Division of the A. C. L., to be known as the Newberry District of the Second Division. E. S. Spencer has been appointed Superintendent of this district, with headquarters at Jacksonville, Fla. The jurisdiction of the following officers of the Operating Department of the A. C. L. has been extended over the Newberry District: E. Borden, General Superintendent of Transportation; E. B. Pleasants, Chief Engineer; F. H. Fechtig, Purchasing Agent; W. B. Denham, General Superintendent, Second Division; R. E. Smith, Assistant to the General Manager; W. P. Cline, Superintendent of Telegraph, and William Flanagan, Car Accountant.

Canadian Pacific.—John Tait has been appointed Assistant Superintendent of Telegraphs on the Central and Western Divisions, with office at Winnipeg.

Cerro de Pasco of Peru.—See San Pete Valley.

Chicago & Eastern Illinois.—S. J. Cooke has been appointed General Freight Agent, and Frank C. Reilly, Assistant General Freight Agent, both with offices at Chicago.

Chicago, Cincinnati & Louisville.—See Cincinnati, Hamilton & Dayton.

Chicago, Peoria & St. Louis of Illinois.—W. E. Killen, Superintendent of Motive Power and Equipment, has resigned.

Cincinnati, Hamilton & Dayton.—The jurisdiction of C. G. Waldo, General Manager, has been extended over the Chicago, Cincinnati & Louisville, one of the roads recently taken into the C. H. & D. system.

Colorado & Northwestern.—The officers of this company are: President, Hon. W. C. Culbertson; Vice-President and General Manager, Robert Law; General Freight and Passenger Agent, L. R. Ford; Chief Engineer, R. S. Sumner; Master Mechanic, M. Fitzgerald, and General Foreman of Buildings, Bridges and Track, George E. Tracy.

Darien & Western.—F. H. McFarland having been relieved of the duties of Auditor and Superintendent, all correspondence relating to the affairs of the company should be addressed to H. D. Emerson, Vice-President and General Manager.

Detroit Southern.—Samuel Hunt has been appointed Receiver, and T. D. Rhodes Treasurer and Assistant to Mr. Hunt. Office at Detroit, Mich.

El Paso & Northeastern.—C. M. Goldman has been appointed Auditor, with office at El Paso, Texas.

Florence & Cripple Creek.—The headquarters of J. H. Waters, President and General Manager; W. W. Phelps, Secretary and Treasurer, and G. W. Shannon, Auditor, have been removed from Denver to Cripple Creek, Colo. W. A. Matlock has been appointed General Freight Agent, and J. B. Wiggenhorn, General Passenger Agent, both with offices at Cripple Creek. J. B. Middaugh, hitherto Trainmaster, has been appointed Superintendent.

Georgetown & Western.—W. B. Wright has been appointed General Freight and Passenger Agent.

Gulf, Colorado & Santa Fe.—A. Harrity, hitherto Division Master Mechanic of the Atchison, Topeka & Santa Fe, has been appointed Mechanical Superintendent of the G., C. & S. F., with headquarters at Cleburne, Tex., succeeding W. E. Symons, resigned. (See Kansas City Southern.)

Illinois, Iowa & Minnesota.—The officers of this company, are: President and General Manager, H. W. Seaman; Secretary, J. C. Duffin; Treasurer, W. F. McSwiney, and Chief Engineer, I. W. Troxel, all with offices at Chicago, except the chief engineer, whose office will be at Aurora, Ill.

Kansas City Southern.—W. E. Symons, hitherto Mechanical Superintendent of the Gulf, Colorado & Santa Fe, has been appointed Superintendent of Machinery of the K. C. S., succeeding Mord Roberts. Mr. Symons' headquarters will be at Pittsburg, Kan. Effective Aug. 15.

Mobile & Ohio.—John M. Beall, hitherto Assistant General Passenger Agent, has been appointed General Passenger Agent, with headquarters at St. Louis, Mo., succeeding C. M. Shepard, resigned, effective Aug. 15.

Quebec Central.—Frank Grundy, General Manager, has been appointed Vice-President, also.

San Pete Valley.—Halbert S. Kerr, General Superintendent and General Freight and Passenger Agent, has resigned to become General Manager of the Cerro de Pasco Railway of Peru.

Southern Indiana.—J. W. Walsh has been elected Vice-President, succeeding James Walsh, resigned.

Spokane Falls & Northern.—R. C. Morgan, hitherto Superintendent, has been appointed Secretary, with office at Spokane, Wash.

Tavares & Gulf.—The office of the General Manager has been removed from Orlando to Clermont, Fla. H. F. Phipps, Auditor, has resigned.

Tehuantepec National.—P. H. Kilpatrick, hitherto Roadmaster, has been appointed Superintendent, with headquarters at Rincon Antonio, Mexico.

Toledo, St. Louis & Western.—K. A. Gohring, Division Superintendent, has resigned.

Washington County.—L. F. Tobie has been appointed Assistant General Freight and Passenger Agent, with headquarters at Calais, Me., succeeding H. F. Burpee, resigned.

West Shore.—G. K. Thompson has been appointed General Western Passenger Agent, with office at Chicago, succeeding J. W. Cook.

LOCOMOTIVE BUILDING.

The Atchison, Topeka & Santa Fe is having 18 locomotives built at the Baldwin Locomotive Works.

The Deep Water Railroad is having one locomotive built at the Richmond Works of the American Locomotive Co.

The Erie is reported to have given an order to the American Locomotive Co. for repairing a large number of locomotives. The exact number on which the repairs will be made is not definitely stated.

The Chicago & North Western, as reported in our issue of July 29, is having 12 locomotives built at the Schenectady Works of the American Locomotive Co. These locomotives will be of the standard class D type and will weigh about 159,000 lbs., with 92,000 lbs. on drivers; weight on truck, 33,000 lbs., and weight on trailer wheel 34,000 lbs.; cylinders 20 in. x 26 in.; heating surface, 3,015 sq. ft., with 46¼ sq. ft. of grate surface and a working steam pressure of 200 lbs. and a tank capacity of 7,250 gallons.

The Chicago & Western Indiana, as reported in our issue of August 5, is about to order three mogul (2-6-0) locomotives and three suburban locomotives. The mogul locomotives will weigh 157,000 lbs., with 136,000 lbs. on the drivers; diameter of drivers, 57 in.; radial stayed boiler; tank capacity, 4,000 gallons of water, and coal capacity, seven tons. The special equipment will include: Westinghouse air-brake and Sullivan piston rod packings. The suburban locomotives will weigh 190,000 lbs., with 130,000 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 63 in.; radial stayed boiler, with a working steam pressure of 200 lbs.; 329 tubes 2 in. in diameter and 13 ft. long; carbon fire-box, 102 in. long and 66 in. wide; tank capacity, 3,500 gallons of water, and coal capacity, five tons. The special equipment will include: Cooke bell ringer, National-Hollow brake-beams, Gould couplers, Adams & Westlake headlights, Nathan injector and Leach sanding devices.

The Northern Pacific has ordered 25 simple freight Mikado-type (2-8-2) locomotives and six simple passenger Pacific type (4-6-2) locomotives from the Schenectady Works of the American Locomotive Co. for September and October delivery. The (2-8-2) locomotives will weigh 240,000 lbs., with 190,000 lbs. on the drivers; cylinders, 24 in. x 30 in.; diameter of drivers, 63 in.; extended wagon top radial stayed boiler, with a working steam pressure of 200 lbs.; heating surface, 4,350 sq. ft.; 392 charcoal iron tubes, 2 in. in diameter and 20 ft. long; wide fire-box, 96 in. long and 66 in. wide; tank capacity, 8,000 gallons of water, and coal capacity, 12 tons. The (4-6-2) locomotives will weigh 215,000 lbs., with 140,000 lbs. on the drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 69 in.; extended wagon top radial stayed boiler, with a working steam pressure of 200 lbs.; heating surface, 3,650 sq. ft.; 349 charcoal iron tubes, 2 in. in diameter and 19 ft. long; wide fire-box, 96 in. long and 66 in. wide; tank capacity, 6,000 gallons of water, and coal capacity, 12 tons. The special equipment for both includes: Westinghouse air-brakes, Gollmar bell ringer, Pyle-National electric headlights for passenger locomotives, Hancock injector, Consolidated safety valve, Leach sanding devices, Railway Steel-Spring Co.'s springs, and truck wheel tires, cast-iron tender wheel tires for freight locomotives and Railway Steel-Spring Co.'s tender wheel tires for passenger locomotives.

CAR BUILDING.

The Baltimore & Ohio is asking bids on 250 refrigerator cars.

The American Car & Foundry Company has miscellaneous orders for 78 cars.

The Ohio & Kentucky has ordered one caboose from the American Car & Foundry Co.

The St. Louis Southwestern has ordered 100 stock cars from the American Car & Foundry Co.

The New Orleans & Northeastern has ordered 200 box cars from the American Car & Foundry Co.

The Richmond, Fredericksburg & Potomac has ordered four passenger coaches from the American Car & Foundry Co.

The Monongahela Connecting has ordered 100 coke cars and 50 steel construction cars from the American Car & Foundry Co.

The Atlantic Coast Line is asking bids on 500 freight cars of 60,000 lbs. capacity, date of delivery to be not later than September 15.

The Baltimore & Ohio is reported in the market for a large number of cars. As we go to press, this report cannot be verified, but the number is stated to be between 300 and 500.

The Minneapolis, St. Paul & Sault Ste. Marie reports that the 200 box cars which it recently ordered from the American Car & Foundry Co. are in addition to the 300 which were ordered from the same company in February. The specifications for these box cars may be found in our issue of February 5.

The San Pedro, Los Angeles & Salt Lake, as reported in our issue of July 22, has ordered 15 oil cars from the Pressed Steel Car Co. for August delivery. These cars will weigh 42,000 lbs. and will have a capacity of 12,500 gallons. They will be 41 ft. 10 in. long, 9 ft. 8 in. wide, and 12 ft. 11 in. high, with steel frames and underframes.

The Buffalo & Susquehanna has ordered 250 all-steel drop-bottom gondola cars and 150 side dump coke cars from the Pressed Steel Car Co. The gondola cars will be 43 ft. 9 in. long and the coke cars will be 41 ft. 9 in. long. Special equipment includes: cast-iron wheels, Pressed Steel Car Co.'s brake-beams, doors and fasteners, M. C. B. couplers, journal bearings and side bearings.

The Michigan Central, as reported in our issue of August 5, has ordered 77 merchandise cars of 80,000 lbs. capacity from the American Car & Foundry Co. These cars will be 35 ft. long, 8 ft. 2⅜ in. wide and 7 ft. 10 in. high, all inside measurement, with wooden frames and underframes. Special equipment includes: Simplex bolsters, Westinghouse brakes, National-Fulton brasses, Monarch couplers, Smith doors, Gould draft rigging, Harrison dust guards, Diamond arch-bar trucks and Hutchins outside metal roofs.

The Denver, Northwestern & Pacific, as reported in our issue of July 15, has ordered 50 box cars of 60,000 lbs. capacity from the Pullman Co. The cars will weigh 33,000 lbs., and measure 36 ft. long, over sills; 8 ft. 6 in. wide, inside measurement; and 8 ft. high. The special equipment includes: Carbon steel axles, American Steel Foundries' bolsters, Christy Congdon brake-shoes, Westinghouse air-brakes, More-Jones Co.'s brasses, Climax steel couplers, Security doors, Republic friction draft rigging, McCord dust guards and journal boxes, Sherwin-Williams paint, Chicago-Cleveland improved Winslow roofs, Railway Steel-Spring Co.'s springs and Diamond arch-bar American freight trucks.

BRIDGE BUILDING.

BUFFALO, N. Y.—Bids are wanted August 25 by the Department of Public Works for the substructure and superstructure of a bascule bridge over the Buffalo River on Ohio street.

CHATTANOOGA, TENN.—Plans have been completed for building a bridge across the railroad tracks at Eleventh street. The bridge will be a pin-connected steel truss 176 ft. long and 18 ft. above the tracks.

CINCINNATI, OHIO.—The City Council, at a recent meeting, passed an ordinance authorizing the Board of Public Service to let contracts for building a viaduct from Grandin road over Delta avenue, at a cost of about $202,200.

COLUMBIA, LA.—Bids will be received by the Commissioners of Caldwell County until September 1 for building a steel bridge across the Ouachita River. George Wear is Chairman, and R. R. Redditt, Secretary.

COLUMBUS, OHIO.—Plans, it is reported, are being made by County Engineer Walter B. Raun for a two-span bridge to cost about $90,000.

HARRISBURG, PA.—The court has approved the report of viewers recommending the building of bridges by the State over the Catawissa in Columbia County at the following places: Breisch's, $13,500; Catawissa, $20,000; Shermantown, $20,000; and Packer Mill, $25,000.

The Board of Public Service and Grounds has directed the secretary to ask for bids for building a bridge at Safe Harbor, in Lancaster County.

The Steelton & New Cumberland Bridge Co. has been incorporated with a capital of $300,000, to build a steel bridge 4,500 ft. long over the Susquehanna river at Steelton.

INDIANAPOLIS, IND.—The Board of Public Works has adopted the plans prepared by the City Engineer for a new three-span bridge about 200 ft. long over Fall Creek. The specifications provide for bids being received on a stone bridge and on a Melan concrete arch. The bridge will cost in the neighborhood of $60,000.

NESCOPECK, PA.—Viewers recommend the building by the State of a two-span steel bridge 200 ft. long to carry double track, at a cost of about $15,000.

NEWPORT, IND.—Bids are wanted August 22 by the Board of County Commissioners for building the stone abutments and piers for a highway bridge over the Wabash River.

NEW YORK, N. Y.—Bids are wanted August 16 at the Aqueduct Commissioner's office for building a highway bridge, with a superstructure of concrete and steel 200-ft. span over the spillway of the new Croton dam in the town of Cortland, Westchester County, N. Y.; also for furnishing and placing sluice gates, drains, valves, and the necessary lifting machinery, floorbeams and plates, pipes, special castings, etc. William E. Ten Eyck is President.

PAULDING, OHIO.—Bids are wanted August 24 by O. Morrow, County Surveyor, for building a steel bridge on a concrete foundation.

PHILADELPHIA, PA.—Plans for two bridges to be built by the Philadelphia & Reading over Pennypack Creek, near Bustleton, in the 35th ward, were approved recently by the Board of City Surveyors.

PITTSBURG, PA.—At the close of the hearing before Secretary Taft on August 5, to reconsider the proposition of Secretary Root requiring the elevation of the union railroad bridge across the junction of the Allegheny and Monongahela rivers at Pittsburg, Mr. Taft suspended until October 1 the order to elevate the bridge, at which time the entire question of the Allegheny bridges will be taken up.

SANDUSKY, OHIO.—The Lake Shore & Michigan Southern, it is reported, will build a new drawbridge.

Saskatoon, N. W. T.—The Qu'Appelle, Long Lake & Saskatchewan Railway Company is to replace the Saskatoon bridge with a steel structure, to cost $250,000. Extensive improvements are proposed on the Prince Albert branch of the Canadian Pacific.

Sayre, N. Y.—The Owego (N. Y.) Bridge Co., which was awarded the contract to build a steel approach to the Sayre bridge, has also received a contract at about $300,000 for putting up a number of steel bridges at Steelton, Pa. This company also recently received a contract for a $23,000 bridge at Afton, and for a $27,000 bridge at Pond Eddy, N. Y.

South Bend, Ind.—Bids will be received by J. W. Harbon, Auditor of St. Joseph County, until August 18, for building a steel concrete bridge over the St. Joseph River. The bridge will be 554 ft. long and will cost about $125,000.

Toronto, Can.—A bridge is proposed over the Don at Danforth, to cost about $200,000.

Tucson, Ariz.—On the Sonora branch of the Southern Pacific six iron bridges were carried away by recent floods.

Ulster, Pa.—The State will rebuild at a cost of about $140,000 the bridge which was destroyed by high water. The new bridge is to be 2,005 ft. long, with four river spans and 10 shore spans. The State will rebuild the bridge in Bradford County which was destroyed by recent floods.

Waterloo, Iowa.—Bids are being asked by City Clerk L. H. Stevens for building bridges over Virginia Creek, at Webster street and at Logan avenue; also over the creek at Lincoln street.

Windsor, Ont.—Sandwich County Council has authorized the raising of $30,000 for building several iron bridges over Belle river.

Wingham, Ont.—Bids are wanted August 16 by John Ansley, County Commissioner, for building the superstructure of three bridges in Huron County.

Other Structures.

Asheville, N. C.—Plans have been completed for a new station for the Southern Railway. The contract has not yet been let, but the cost of the new building is estimated at about $67,000.

Baltimore, Md.—The new freight warehouse which the Baltimore & Ohio is about to build on Eutaw street is to be eight stories high, 416 ft. long, and 50 ft. wide. The building is to be of brick and work will be begun as soon as the contract is let.

Brooklyn Heights R. R.—The work of the extension of the elevated section of the Brighton Beach Railroad over Park place and Prospect place, Brooklyn, N. Y., for a distance of about 1,000 feet, according to the plans of the Brooklyn Grade Crossing Commission, has been given out to several contractors. The Cranford Company has the principal contract for excavating, masonry and paving. McClintock & Marshall have the contract for constructing the steel bridges over the two highways above named and Milliken Bros. will build the station and platform. The total of the above named contracts is about $70,000. Other expenses in connection with the work of the entire extension will bring the total cost up to about $100,000, of which the B. H. R. R. will pay half and the city half. Work has already been begun at St. Mark's place for building the temporary inclines.

Carlton, Minn.—The Northern Pacific, it it reported, is considering the question of removing its Gladstone shops to this place.

Clinton, Iowa.—The Chicago & North Western, it is reported, is considering the question of building large shops here if the city will give the necessary land.

Duluth, Minn.—The North Western, it is reported, is making plans for a new freight house to cost about $30,000, to replace the one recently destroyed by fire.

El Paso, Tex.—A contract will soon be awarded for the union passenger station to be built here.

Glenwood, Iowa.—The Chicago, Burlington & Quincy, it is reported, will build a brick passenger station here.

Grand Rapids, Mich.—Plans are being made by the Holland and the Muskegon roads for a two-story stone and brick building to contain the offices of both companies, at a cost of about $30,000.

Hutchinson, Mex.—It is reported that work will be begun within a few days on the erection of the shops of the Mexican Car & Foundry Co. at this point. Excavations have been completed and material for building the shops is already on the ground. There will be nine buildings in all.

Long Island City, N. Y.—Plans have been approved for a three-story brick electrical sub-station 86 ft. x 53 ft., to be built by the Long Island Railroad at Jamaica at a cost of about $35,000; also for a one-story brick machine and carpenter shop 60 ft. x 200 ft. for the same company, to be built at Whitestone landing, at a cost of about $20,000.

Milwaukee, Wis.—The Milwaukee Electric Railway & Light Co. will build an addition to its works four stories high, 83 ft. x 144 ft.

Mobile, Ala.—Plans for a union station at Mobile, to cost not less than $150,000, have been submitted to and approved by the State Railroad Commission in Alabama. Work will be begun at once.

Morgantown, Pa.—Plans for a new station for the Baltimore & Ohio at this point, costing about $35,000, have been approved and work will shortly be begun.

Norfolk, Va.—The U. S. Government will build a general storehouse of brick and steel 50 ft. x 100 ft., two stories high, at the foot of South Main street, to cost about $50,000.

St. Louis, Mo.—The American Refrigerator Transit Co.'s repair shops were destroyed by fire August 9 with 65 refrigerator cars, at a loss of about $300,000.

Sherman, Tex.—The St. Louis & San Francisco, it is reported, will build machine shops.

Sydney, N. S.—Bids are wanted August 19 by D. Pottinger, General Manager, Intercolonial Railway, Moncton, N. B., for building a brick and stone passenger station at Sydney.

Terre Haute, Ind.—The C., C., C. & St. L. and the Southern Indiana, it is said, are planning to jointly build a new passenger station in the northern part of the city.

Westfield, N. Y.—It is reported that contracts will soon be let by the Lake Shore & Michigan Southern for a new station, costing about $25,000.

Yankton, S. Dak.—The Chicago, Milwaukee & St. Paul, it is reported, will build a new passenger station at the corner of Eighth street and Douglas avenue; also a new freight house.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atlanta & Birmingham Air Line.—It has been officially announced that the extension of this road between Atlanta, Ga., and Birmingham, Ala., will be opened for traffic before the beginning of the new year.

Buffalo & Southeastern (Electric).—Incorporation has been granted this company in New York with an authorized capital of $300,000 to build an electric railroad from East Aurora northwesterly through Spring Brook to Buffalo, a distance of 15 miles. F. H. Ball, E. E. Henshaw and others, of East Aurora, N. Y., are incorporators.

Denver, Northwestern & Pacific.—This road has organized a separate terminal company known as the Northwestern Terminal Railroad Company with an authorized capital of $2,500,000. The object of the new company is to build a terminal railroad in Denver for the D. N. W. & P. line. Beside the actual right-of-way into the city sufficient ground will be acquired for building passenger and freight stations, yards and terminal facilities in general. Davd H. Moffat will be one of the directors of the new company.

Dublin & Southwestern.—It is reported that track laying will be begun within a few days on that portion of this road between Rentzville, Ga., and Eastman, 17 miles. The main line is now being built from Dublin southwest through Eastman to Abbeville, 45 miles. E. P. Rentz, Dublin, Ga., is President and Chief Engineer. (March 11, p. 200.)

Gainesville Midland.—This company has been organized in Georgia as the successor of the Gainesville Jefferson & Southern, running from Gainesville to Monroe, Ga. G. J. Baldwin, Savannah, Ga., is interested. (See Railroad News, Aug. 5, p. 52.)

Grand Rapids, Holland & Chicago.—Articles of incorporation have been filed by this company in Michigan. It is understood that the company will take over the property of the present Grand Rapids & Holland Railroad and will operate the line under the above name. W. H. Beach, J. K. Andrews, A. L. Stephens and others, of Grand Rapids, Mich., are interested.

Greenville & Leland (Electric).—Articles of incorporation have been filed by this company in Louisiana to build an electric railroad from Greenville northwest to Leland, 10 miles. J. L. Hebron, Greenville, La.; J. W. Thompson, Leland, and others are incorporators.

Guelph & Goderich.—It is reported that this company is advertising for bids for work on eight sections of 10 miles each between Guelph, Ont., and Goderich. The headquarters of the company are at Guelph.

Interstate.—Contracts for building this railroad from Kansas City to Duluth are reported let to the Quigley Construction Company, of St. Louis. The work will be in charge of A. C. Titus, chief engineer, and will be pushed from the southern terminus. It is stated that active building operations will be undertaken at once. The total distance is 1,600 miles. J. H. Pickering, Kansas City, is President. (April 29, p. 336.)

Mexican Roads.—Work has been begun on the first 26 miles of the San Carlos Copper Co.'s line from San Jose to Linares. The road will be standard gage and will connect at Linares with the National of Mexico. Under the terms of the concession, the line may be extended to Sota la Marina. The object in building the road from San Jose to Linares is to furnish the San Carlos Copper Co. with facilities for carrying its ore to the coast.

Meyersdale & Salisbury (Electric).—Incorporation has been granted this company in Maryland to build an electric railroad from Garrett, Pa., to Frostburg, Md., a distance of 25 miles. The contract for building the line has been let to Thomas Deegan & Co., of Philadelphia.

Minneapolis & Rainy River.—An officer writes that this company has purchased the railroad belonging to the Itasca Lumber Co., running from Deer river, Minn., to Turtle creek, with a branch southwest to Bass Lake, a total length of about 40 miles. The new company will operate the road under the above name. No extensions are contemplated during the present year. W. T. Joyce, Chicago, Ill., is President, and F. C. Gerhard, Minneapolis, Minn., General Manager. (July 29, p. 47.)

Missouri & Illinois Bridge & Belt.—A charter has been granted this company in Missouri with an authorized capital of $2,500,000. It is proposed to build a railroad from a connection with the Wabash near Ferguson, Mo., to a connection with the St. Clair, Madison & St. Louis Belt Railroad.

The latter road operates the bridge over the Mississippi river at Alton. The total length of road will be 15 miles. Joseph Ramsey, Jr., A. J. Davidson, B. L. Winchell, M. H. Smith, James McCrae, Oscar Murray, George J. Gould, L. T. Jeffrey and M. E. Ingles are directors.

MOUNT AIRY & EASTERN.—Surveys are reported completed for an extension of this road from the Dan river to Stuart, Va., 10 miles. It is stated that work will shortly be begun. S. A. White, Stuart, Va., is Chief Engineer.

MUSKOGEE UNION.—Press reports state that about 40 miles of the proposed extension between Muskogee, Ind. T., and Whitesboro, Tex., is graded. The Kenefick Construction Co. has the contract. C. N. Haskell, Muskogee, Ind. T., is President. (April 15, p. 298.)

SHORT CREEK VALLEY.—Incorporation has been granted this company in Ohio to build a railroad from New Athens, in Harrison County, northeast to Dillonvale, in Jefferson County, 15 miles. W. P. Moore, E. B. Thomas and others are incorporators.

SOUTH ATLANTIC & MEXICAN GULF.—A charter has been granted this company in Georgia with an authorized capital of $3,000,000 to build a railroad from Savannah southwest to a point on the Gulf of Mexico, 325 miles. P. H. Comas and F. J. Sweat, Savannah, are among the incorporators. (June 3, p. 430.)

SOUTHERN.—Press reports state that this company will soon begin work on a new line from Itta Bena, Miss., southwest to Belzona, 30 miles. Surveys for this line have been completed. The line will be in the nature of an extension of the branch now in operation between Webb and Itta Bena.

UNION PACIFIC.—An officer writes denying the report that work has been begun on double tracking the Kansas division between Kansas City and Topeka. No such work is contemplated on this division at present.

RAILROAD CORPORATION NEWS.

CANADIAN PACIFIC.—The report of this company for the fiscal year ending June 30, shows the following results: Gross earnings, $46,469,132; operating expenses, $32,256,027; net earnings, $14,213,105; total net income, $15,904,374; net available for dividends, $8,088,277. After payment of all fixed charges and dividends for the year the surplus carried forward was $1,666,204.

CENTRAL OF GEORGIA.—This company has declared the regular 5 per cent. dividend on its $4,000,000 first preferred income bonds, and a dividend of 2 per cent. on the $7,000,000 second preferred income bonds. This is the first dividend on the last named.

CHICAGO GREAT WESTERN.—Everez & Co., Chicago, are offering part of an issue of $2,500,000 5 per cent. gold notes of this company. The agreement under which these notes are issued provides that the company cannot issue notes in excess of $500,000 in any one year, and also provides that the company cannot place a lien on its property without first providing for the payment of these notes.

CINCINNATI, HAMILTON & DAYTON.—It has been officially announced that in carrying out the merger of the C., H. & D. and the Pere Marquette, $11,000,000 of the Pere Marquette common stock was purchased on a basis of $110. In exchange for this, there were paid $8,250,000 in the refunding bonds of the C., H. & D. at $90, and $5,550,000 two-year notes convertible into common stock at 85. The Pere Marquette owns $4,050,000 of the $4,350,000 stock of the Chicago, Cincinnati & Louisville, the new line which has just been completed to Chicago. This stock was paid for with $3,500,000 ten-year 4 per cent. notes of the Pere Marquette. The indenture of these notes provides that they shall bear no interest for the first year.

DETROIT SOUTHERN.—Samuel Hunter, receiver, has asked permission from the United States district court to issue additional certificates to the amount of $400,000 for the purpose of meeting the demands of the creditors and to make improvements on the property of the company.

The bondholders' protective committee has notified the holders of first mortgage 50-year 4 per cent. gold bonds that the time for the deposit of bonds with the New York Security & Trust Co. has been extended to Aug. 15, after which date the committee reserves the right to impose such conditions as it may deem proper.

ILLINOIS CENTRAL.—Speyer & Co. have announced the purchase of $2,663,000 of the fifty-one-year Omaha Division first mortgage 3 per cent. bonds authorized in 1900. Shortly after the line between Tara and Council Bluffs, Iowa, was merged into the Illinois Central system in 1900, a mortgage for $5,000,000 was placed on the property. The $2,663,000 is a part of the unsold bonds of this issue which have until now been held in the treasury of the company.

MEXICAN CENTRAL.—It has been announced that the entire $10,000,000 6 per cent. 2½-year notes of this company have been sold in Europe. These notes were purchased by a syndicate composed of Hallgarten & Co. and Ladenburg, Thalman & Co. The notes are secured by a deposit of $16,000,000 of the consolidated first mortgage gold bonds of the company, some priority bonds and a block of Tampico harbor bonds. The proceeds of the sale are to be used to pay off floating indebtedness, amounting to about $7,750,000, and for improvements and betterments. It is stated that the syndicate was closed at a considerable profit.

NEWTON & NORTHWESTERN.—This company has filed a mortgage for $600,000 with the Adams Trust Company of Boston as trustee. The bonds will run for ten years and will bear interest at the rate of 5 per cent. They will be a first mortgage on the entire main line between Newton, Iowa, and Rockwell City, 104 miles, and all branch lines. The proceeds will be used to refund $300,000 funding mortgage bonds and for further improvements.

NEW YORK, NEW HAVEN & HARTFORD.—The $10,000,000 New England Railroad Company general mortgage bonds have been awarded to J. P. Morgan & Co. at 106. These bonds are to pay off the $6,000,000 7 per cent. and $4,000,000 6 per cent. first mortgage bonds of the New England maturing January 1, 1905.

NEW YORK, WESTCHESTER & BOSTON.—The Mayor of New York has signed the franchise recently passed by the Board of Aldermen granting the right to this company to cross certain streets in the Borough of the Bronx. Last spring this same measure was vetoed on the ground that no provision was made for compensation to the city. (July 29, p. 47.)

QUEBEC SOUTHERN.—Bids for the purchase of this railroad were opened by the Exchequer Court at Ottawa on August 3; but they were unsatisfactory, and the court was adjourned until August 15, when a meeting will be held to determine what shall be done with the property.

STATEN ISLAND RAPID TRANSIT CO.—New York city officials, it is reported, have reached an agreement with the Staten Island Ferry officials for taking over the boats, terminals and land under water, owned by the Staten Island Rapid Transit Co., and the contract will soon be closed. Under the terms of the agreement now made, the city will probably pay about $540,000 to the company.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, AUGUST 12, 1904.

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